Disclosure File P0011367.00

DEFLECTABLE CATHETER WITH NOVEL LUMEN CONSTRUCTION

Division: LT021	**Status:** O	**Attorney:** ELB
SubDivsion: LT021	**SubStatus:** REV	**Outside Counsel:**
Group: CRM	**Priority:** X	
Submitted:	**Approved:**	**Last Review:**

Goode, Johnson E.
Spear, Stanten C.
Kelley, James F.

Minutes:

Other Information:

Date	Description	Information

LT021
ELB
P-11367.0C

Medtronic

INVENTION DISCLOSURE FORM

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This is a WORD Template form. Press enter or tab to move to each field. Please fill out this form as completely as possible. If the allotted space is not sufficient, use a separate sheet. Have your manager sign the form and forward it to the Patent Section of the Law Department, MS301. Please attach any drawings and technical descriptions that are available and assemble copies of the background articles, books, advertisements, etc. for use by your patent attorney.

1.

Inventor(s) Full Name(s)	Employee Number	Mail Stop	Home Address (Include Zip Code)
Johnson Eric Goode		B230	6425 Polaris Ln N, Maple Grove, MN 55311-4320
Stanten Charles Spear		B248	1752 Chatham Ave., Arden Hills, MN 55112-3226
James Frederic Kelley		B230	13000 Nightingale Street NW, Coon Rapids, MN 55448

2. Title of Invention: **Deflectable Catheter with Novel Lumen Construction**

3. Summary of the Invention:

A deflectable catheter with a thru lumen has great clinical utility in left heart therapy delivery procedures by allowing a guide wire or contrast agent to be used during the procedure while using the same deflectable catheter. This ability increases the physician's situational awareness and therefore increases the probability of success and decreases the chance of venous trauma. A common drawback of having a deflectable catheter with a thru lumen is that the deflection mechanism takes up so much interior lumen space that in order to make the lumen large enough to be useful, the outer diameter of the catheter would increase to unacceptable dimensions.

Pull wires are commonly applied to catheters to enable the catheter to be deflected by pulling back on the pull wire which in turn compresses the distal end of the catheter, creating the deflection. If one needs to incorporate a thru lumen into the catheter it is common practice to segregate the pull wire from the lumen by use of a multi-compartment catheter, with separate compartments for the pull wire and thru lumen. This method has the disadvantage of reducing the amount of area available for the thru lumen, due to the wall thickness of the segregated compartments, which in turn reduces the maximum lumen diameter that can be used at a given catheter outer diameter.

This invention solves the above problem by increasing the effective size of the pull wire member by containing the distal end of the pull wire in a spring, or other compressible member, and using this to hold the pull wire in place in the lumen of the catheter. The spring, or compressible member, is attached to the catheter member at 1 or no ends of the catheter shaft to allow relative movement between the spring and pull wire. This allows the elimination of the individual compartments and their associated separation walls and will maximize the size of the thru lumen for a given catheter outer diameter. It is no longer necessary to separate the pull wire from the through lumen and a common lumen profile can be used to contain both.

4. How have others addressed this problem (List and attach any patents, books, articles, devices, Medtronic or competitor's products, or other background materials you used or which may be prior art)? **A prior Medtronic device, the 9210 catheter, employs a bi-lumen tubing. A steerable member or guide wire is placed in the outer tubing which then directs the other, non-obstructed tubing. This method is fundamentally different from the disclosed method in that both lumens are still segregated with the associated wall thickness. Another company Daig/St. Jude employs an X shaped lumen which provides for a flat spring or other flat member that separates the lumen into two compartments. This device does not incorporate a thru catheter lumen. The LumaCath, from Irving Biomedical Inc., has a thru catheter lumen construction that incorporates a interior tubular member that surrounds the thru catheter lumen.**

5. The invention is described on pages **23-25** of Lab Notebook No. **10363 (preliminary, still contained separate bending beam)**

6. When was a device built which included the invention?

Who built it? John Goode Where is it? Medtronic Rice Creek Center

Who has supporting documents? John Goode

Who witnessed tests? Stanton Spear, John Goode, Bob Colbert When and where? May, 2002 Medtronic Rice Creek Center RA lab

7. Discuss the problems which the invention is designed to solve, referring to any prior devices of a similar nature with which you may be familiar. Problem was creating a deflectable catheter with a thru lumen that would fit within dimensional constraints of existing therapy delivery devices. The outer diameter of the catheter has to be 7 Fr or less to allow passage through a 6218A guide catheter. Also, the thru lumen ideally would allow passage of introducer type guide wires, which range up in size to .038 inches, with .025 and .035 inches being most common. Preliminary testing with a .021 in thru lumen indicated that not enough contrast could be passed to be clinically useful. These objectives had to be met while still allowing the deflectable catheter to track over a guide wire, ideally an EP type guide wire between .014 and .018 inches. This has the clinical benefit of leading with a guide wire to minimize risk of venous trauma and allowing for venous subselection. The tip of the deflectable catheter also must be radio opaque to allow visualization using fluoroscopy, and be soft and non traumatic.

8. State the advantages of the invention over presently known devices, systems or processes. The device has a .039 in diameter thru lumen. This is large enough to accommodate up to a .035 in diameter guide wire and large enough to pass clinically useful amounts of contrast. The radio opaque and echo-genic tip eliminates the need for a metallic marker band at the tip, decreasing chance of venous trauma and reducing product costs. The tapered tip facilitates tracking ability over guide wires. The extrusion profile is simpler than competing devices and maximizes the size of the thru lumen at a given catheter outer diameter.

9. List all known and other possible uses for the invention. Therapy delivery devices requiring a lumen, including catheters, leads, dilators, diagnostic catheters or probes, implantable sensors, balloon catheters.

10. Specifically describe the invention and its operation. You may use and attach copies of sketches, prints, photographs and illustrations which should be signed, witnessed and dated. Use numbers and descriptive names in descriptions and drawings. The distal extruded lumen profile is as shown per the drawing. A spring encloses the pull wire. This increases the effective size of the pull wire member to hold the pull wire in the "cut out" area of the catheter lumen profile. The spring may be connected at one or zero points to the catheter side shaft. The spring cannot be connected at more than one location as it must be free to move relative to the pull wire and catheter shaft. In practice, the spring is connected at the distal end via adhesive or polymer backflow from the anchoring band/pull wire junction. The tubing is also fixed on one end (distal) and also cannot be connected between the braided shaft and the deflectable shaft as it must be free to slide with in the catheter body during deflection. The tip section is 48D PEBAX loaded with jet milled tungsten carbide to be both radio opaque and echo-genic. The outer diameter of the deflectable catheter is tapered like a dilator to assist in passage through restricted veins or ostia.

There are several methods in which this catheter can be deployed. The general system consists of a fixed shape sheath, steerable catheter, a guide wire and a lead. The general method includes a sheath that is back loaded on to the steerable catheter with a guide wire inserted into the lumen of the catheter. The outer sheath could be straight or any one of a number of variety of curves such as a MB2, Amplatz or multipurpose. The combination provides multiple degrees of freedom and flexibility to canulate the coronary sinus. The guide wire is extended beyond the end of the catheter and is used to probe for the cs ostium. Contrast media may also be injected to assist in the location. Once the cs canulated, the guide wire is pushed distal and the catheter advanced into the cs. The outer sheath is then advanced into the ostium and serves as a work station for tool exchanges. The catheter is removed and the venogram balloon placed over the wire and a venogram preformed. A physician may elect to remove the guide wire and inject contrast media directly into the venous structure. Depending on the size of the guide wire used, it is reinserted in the catheter and advanced to the targeted sub-vein. The wire is advanced distal in the sub-vein and the catheter and sheath advanced over the wire. The catheter is removed, leaving the sheath and guide wire behind. Depending on the size of the guide wire, the lead is advance directly over the guide wire into position.

This catheter could also be used to deliver small diameter leads to the right side chambers. The ability to push contrast media through the lumen also allows the physician to visualize structures with the heart for precise placement of diagnostics and therapeutic devices.
Another method is in the performance of pulmonary vein ablations. This catheter could be used to safely locate and puncture the fosal ovalis to access the left atrium. Once the puncture is made a sheath would be placed and the catheter advanced to the pulmonary veins. Contrast media is injected through the center lumen to identify the pulmonary vein ostium.

This catheter may also prove useful in cannulating the coronary sinus ostium when the ostium is partially occluded by a Thesbian valve by using a guide wire to pass by the valve and tracking the catheter over the guide wire. The same would apply more distally in the cardiac anatomy by providing a method for passing through the Valve of Vieussens. The ability to visualize using contrast and track past obstructions using a guide wire enables placing the delivery system closer to the final pacing site.

11. List all features of the invention that are believed to be novel. 1) Using a spring or other compressible member to contain the pull wire thereby increasing the effective size of the pull wire member to hold in place in lumen. 2) Attaching the spring on one or zero ends (not both ends, spring must be free to move relative to pull wire and tubing). 3) The tubing does not connect the braided shaft to the deflectable shaft, again must be free to slide within catheter body during deflection. 4) Tapered tip feature in a deflectable catheter, increases in diameter (distal to proximal) to facilitate passing through restricted space such as the coronary sinus thesbian valve, venous valves, etc. 5) Anchoring pull wire in body of catheter, not tip. 6) Radio opaque and echo-genic tip, eliminating the need for metallic marker bands, or separate radio opaque and echo-genic fillers in the polymer. 7) The catheter taper provide back-up support for the guide wire. 8) The catheter provides back-up support for the outer sheath.

    Method claims:
    1) Using steerable catheter with guide wire and delivery sheath to cannulate coronary sinus and establish workstation for delivery of venogram balloon catheter and leads, with or without guide wire 2) Subselecting branch veins by selecting with guide wire and tracking over 3) Performing venogram without necessity of exchanging with a venogram balloon catheter 4) Placing guide wire in final selected site and advancing lead over guide wire. Lead could first be loaded onto an extension wire via the connector end with the extension wire then being connected to the retained guide wire. Then the lead would be advanced over the retained guide wire in the normal manner. This allows Medtronic's OTW lead to be delivered without going backwards through the distal seal. Once the guide wire loading tool is available, could load OTW lead directly over the retained guide wire. 5) Delivery small diameter leads or other devices directly through the steerable catheter 6) Use the catheter to perform Pulmonary Vein ablations by puncturing the fosal ovalis via puncture tool passed thru catheter and then securing left atrial access via guide sheath passed over steerable catheter. 7) Catheter has unique ability to pass thru partially occluded veinous structures such as a Thebesian valve in the coronary sinus ostium or the Valve of Vieussens in the cardiac veins by tracking over a guide wire. The guide wire can be selected for properties that match the specific situation encountered.

12. Sale or Publication (Needed to establish the date of any printed publication, public use or sale, since no U. S. patent application may be filed after one year from such date.)

    a. If a device has been offered, or will be offered for sale, or used for profit or otherwise publicly disclosed, state when and to whom delivered and how used? Has not been publicly disclosed.

    b. Has a printed description of this invention been made available to persons outside the company? How and when and was use restricted (e.g. licensing agreement, non-disclosure agreement, proprietary legends, etc.)? No

13. Inventor(s) Signature(s) **(REQUIRED):**

Signature

Manager's Comments

14. How is this invention important to your products, plans or goals? ____

15. Manager's Signature **(REQUIRED)**

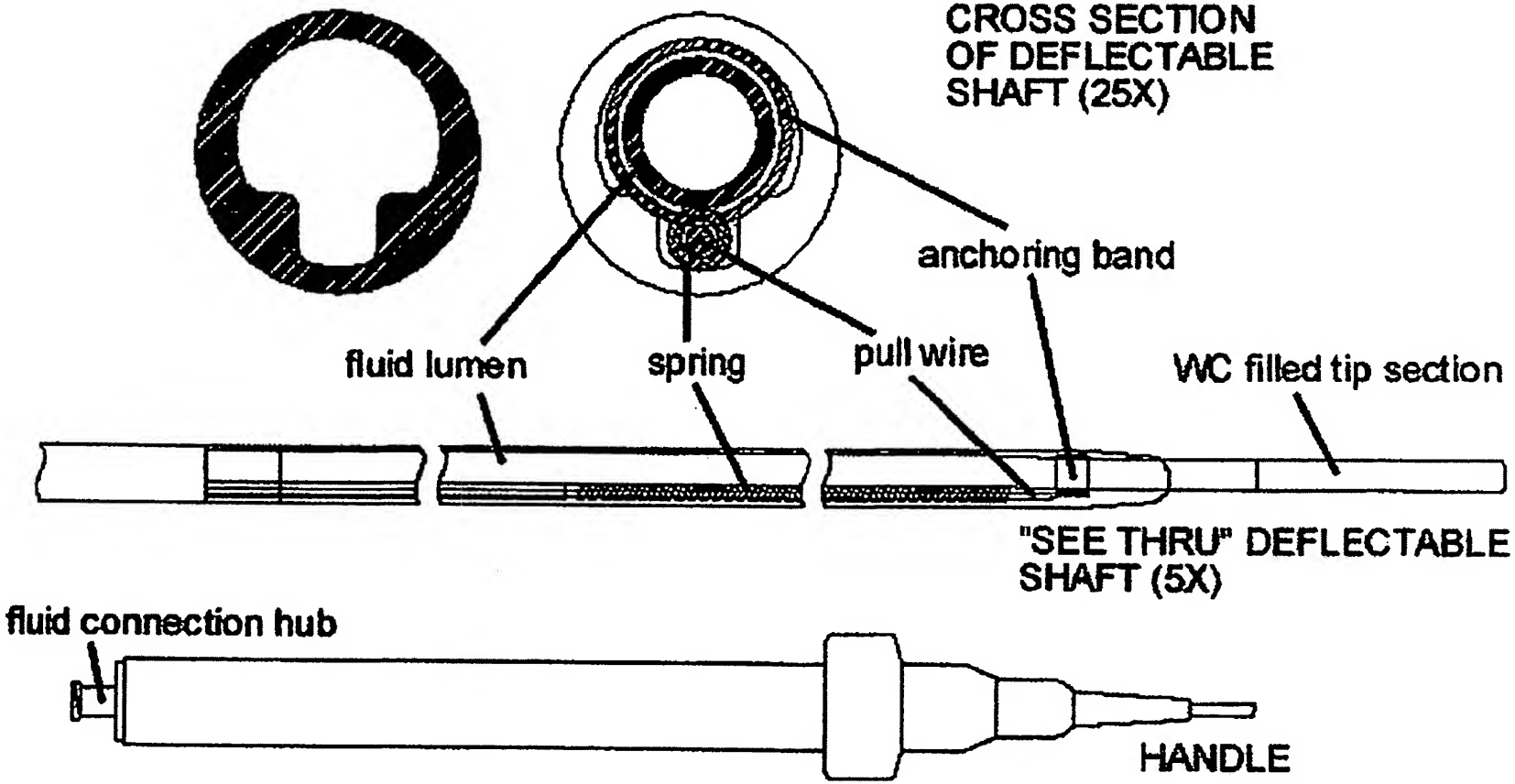
Signature Date

Manager's Printed Name ____ Mail Stop ____

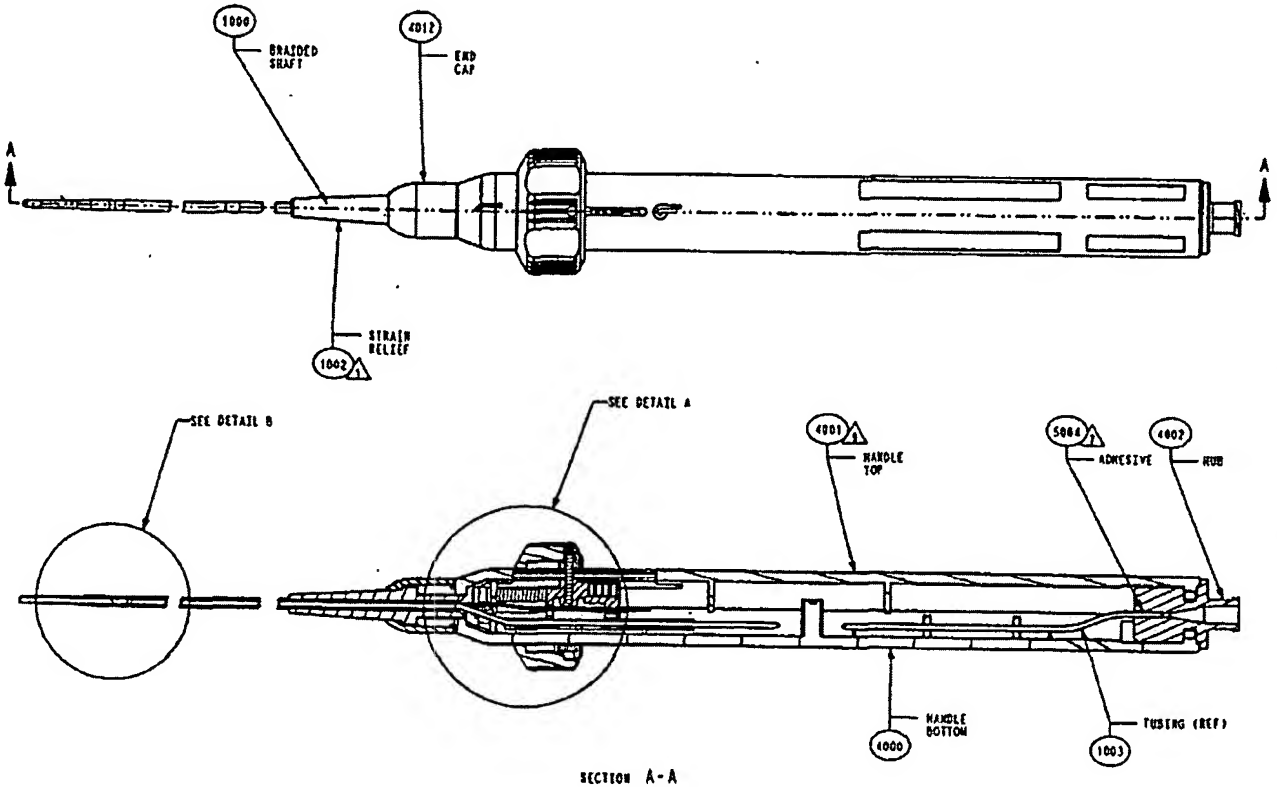
Business Unit____

This is a very important disclosure for the business

Manager: Please forward to Patent Section of Law Department, MS 301, upon completion of your review.


CROSS SECTION
OF DEFLECTABLE
SHAFT (25X)
anchoring band
fluid lumen
spring
pull wire
WC filled tip section
"SEE THRU" DEFLECTABLE
SHAFT (5X)
fluid connection hub
HANDLE

REV	DESCRIPTION	ECO NO	DATE	DRWN	APPD
A	DEVELOPMENT			JM	



SECTION A-A

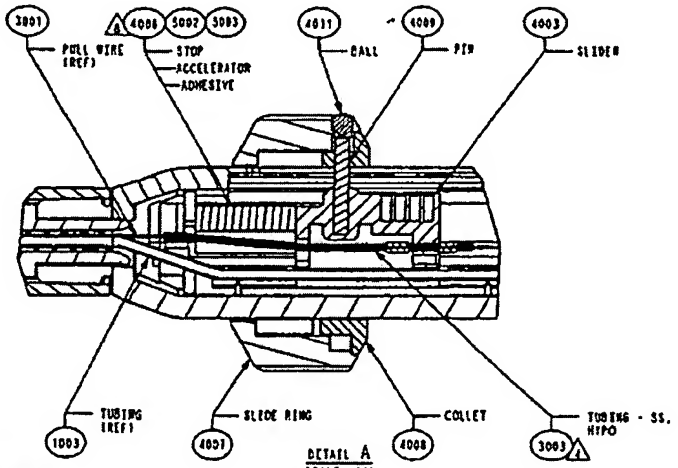
1. STRAIN RELIEF, ITEM 1002, IS FUSED TO BRAIDED SHAFT, ITEM 1000
2. BRAIDED SHAFT, ITEM 1000, IS FUSED TO JOINT TRANSITION TUBING, ITEM 1005, AND DEFLECTABLE TUBING, ITEM 1001.
3. WELDED TIP, ITEM 1007, IS FUSED TO TUBING T-LUMEN, ITEM 1001.
4. HYPOTUBE, ITEM 3003, IS CRIMPED TO PULL WIRE, ITEM 3001.
5. PULL WIRE, ITEM 3001, IS WELDED TO STAINLESS STEEL BAND, ITEM 3000.
6. DEFLECTION TRANSITION TUBING, ITEM 1006, IS FUSED INTO JOINT TRANSITION TUBING, ITEM 1005.
7. TUBING, ITEM 1003, IS BONDED TO HUB, ITEM 4002, USING ADHESIVE, ITEM 5004.
8. SLIDER STOP, ITEM 4006, IS BONDED TO HANDLE TOP, ITEM 4001, USING ACCELERATOR, ITEM 5003, AND ADHESIVE, ITEM 5002.
9. HANDLE TOP, ITEM 4001, IS ULTRASONICALLY WELDED TO HANDLE BOTTOM, ITEM 4000.

Medtronic

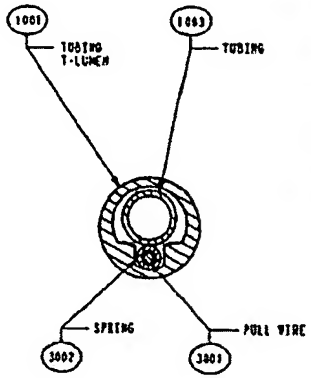
TITLE: CATHETER - PREVAIL, STEERABLE, 1 CURVE, LUMEN, TF

ANGLES ±

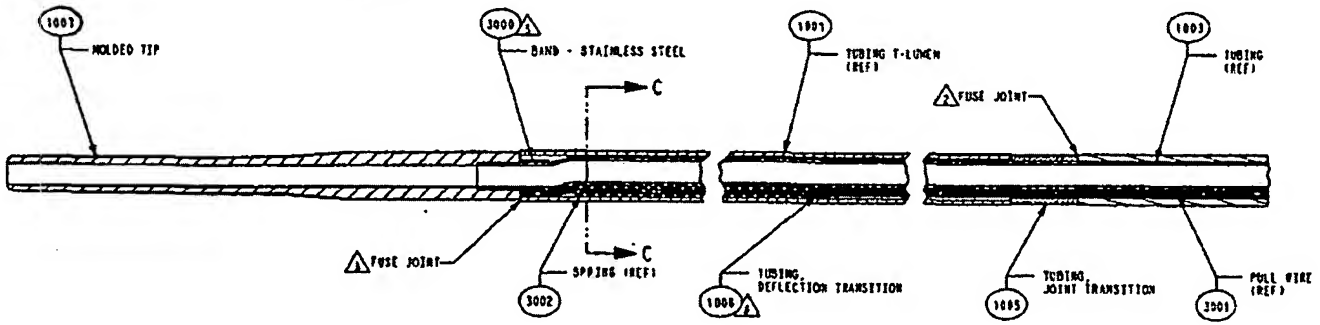
SIZE	DWG NO	REV	SHEET
	503064	A	1 of 2



DETAIL A
SCALE: 4/1



SECTION C-C
SCALE 20.000



DETAIL B
SCALE: 10/1

SECTION B-B
SCALE 10.000

D	503064	A	2

NOTEBOOK NO. 10343

ISSUED TO John Co

NT

SCIENTIFIC NOTEBOOK COMPANY
2831 LAWRENCE AVENUE
STEVENSVILLE, MICHIGAN 49127
(800) 537-3028 - http://www.snco.com

LE T Lumen Tubing

Project No. B4429
Book No. 10657

69

Page No. Material Peltay 400 Part 010331 102 20% R.O. Blue Foster etc.
Foster lot 04102807
Dried at 160°F for 18 HRS —

1" Killion Extruder 1cc Gear Pump Sweco 61 die
12-6-6 screw 60-80-100-60 screens

T lumen
Started with 240 Barb

This Run all Done with 240 Barb
maybe slightly larger Barb 245

	of
1	350
2	375
3	350
4	365
5	365
6	370
7	360
8	355
9	345
10	N/A
Melt	437
Head	1047
Mid	944
Outlet	1045
die	939
Gear Pump R.P.M	85% 29.7
Extruder RPM	15%
Takeoff FPM	46.9
Quench	104°F
Diameter	.825
G.P. Power	61
Extruder Power	28
air set	— 6" water

Heaters Good Started Cooler but I think three heaters are good

Tubing looks good Sent 50 3ft Samples to John Goode on 8/12/02

Tool Drawing 095987

Roundness less than .001

Witnessed & Understood by me,

Date

Invented by

Recorded by

From Page No.___

TITLE

Project No.___

Book No.___

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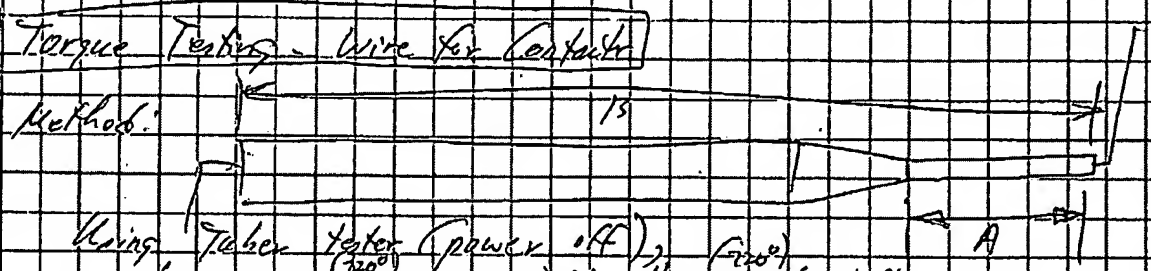
To Page No.___

Torque Testing - Wire for Contacts



Method:

Using Taber Tester (power off), (720°) torque wire 2x to right, then 2x to left.

Manually take a reading from Taber Tester (Stiffness Units)

Do not put any weights on the Taber Tester.

Note: Make right angles at end to grip and track torque angle

@ Testing 2 of each

Wire	A	B	Right reading (720°)	Left reading (720°)
.025" → .015" → .005"	9 cm	120 cm	15, 14.5	17, 16.5
.025" → .015" → .005"	5 cm	120 cm	18, 18	18, 18
.022" → .010"	9 cm	120 cm	16.5, ~~16~~ 17	16.5, 17
.022" → .010"	5 cm	120 cm	22, 22	22, 22
.024" → .008"	9 cm	120 cm	9, 8.5	9, 8.5
.024" → .008"	5 cm	120 cm	14, 14	13, 14
.024" → .010"	9 cm	120 cm	18, 18.5	17.5, 18.5
.024" → .010"	5 cm	120 cm	23.5, 25	23.5, 25
.018" → .005" (54, 100)	9 cm	120 cm	WIRE TOO SHORT	WIRE TOO SHORT
.018" → .008"	5 cm	120 cm	9, 9	9, 9
.024"	110 cm	(straight - no taper)	26 @ 270°, 27 @ 270°	Exceed Travel Limit
.022"	110 cm	(no taper)		
.018"	110 cm	(no taper)	24, 24	24, 24
.010"	15 cm	(no taper)	14, 14	14, 14
.008"	15 cm	(no taper)	6, 7	6, 6.5
.024 (500 TABER UNITS)	110 cm	(NO TAPER)	23, 23	23, 23
.018 (500 TABER UNITS)	110 cm	(NO TAPER)	7, 8	7, 7
.022 500 TABER UNITS	110 cm	(NO TAPER)	16, 16	16, 16

Dec 10

1

Project No.

TITLE Prototypes for Attain project

Book No. 10363

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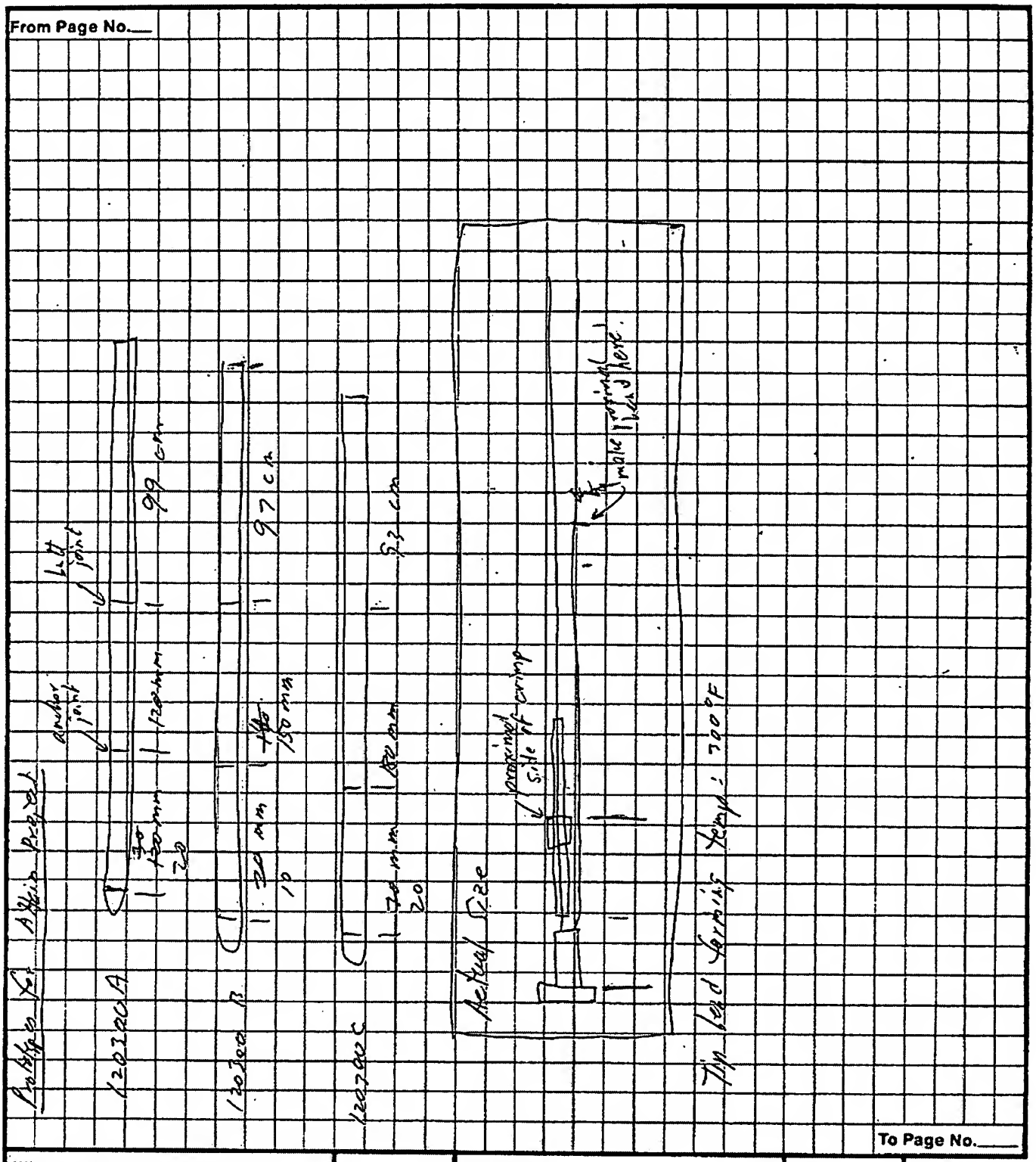

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Witnessed & Understood by me,

Invented by

Recorded by

Date

From Page No. ______

Amazr Butt Fusing Using Narrow Heat Knife   machine ES 18299

Pobax 05654-001 ← 0.0028
Cornu Shift 4640250001 ← m 4728840

machine setting

	Temperature (°F)	Air flow (SCFH)	Compression Delay (sec)	Heat Time (sec)	Cool time (sec)	Throw Block (lok)
(1)	385	25	30	60	25	210

braid visible but acceptable

(2)	380	"	"	"	"	"

braid visible not acceptable

(3)	385	"	"	"	"	"

TC problem -- replaced TC

(4)	455	"	"	"	"	"

braid visible not acceptable ∴ temp probably a little high

(5)	440	"	"	"	"	"

looked good Tensile 11.96 lbs

(6) repeat
looked good Tensile 11.75 lbs

(7) 440 = 445 AΔ = .600, .930
looked good Tensile 11.38 lbs

(8) 410 → 450
looked OK braid visible but not thru surface Tensile 12.10 lbs

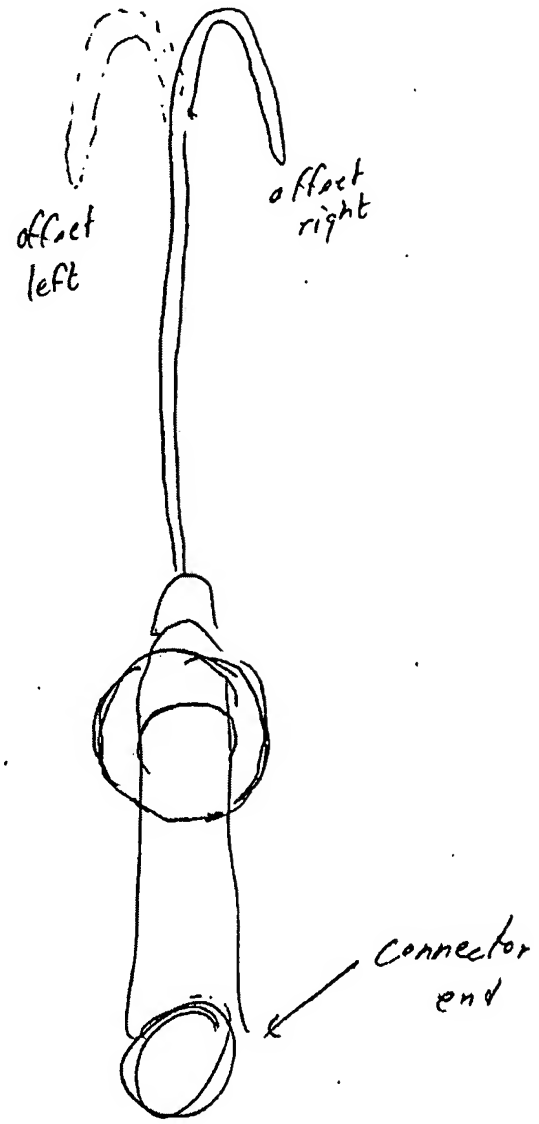
(9) 450
look good kept for sample

To Page No. ______

Witnessed & Understood by me, ______ Date ______

Invented by ______ Date ______

Recorded by Ron Drake


offset left
offset right
connector end

Witnessed & Understood by me. / Date

Recorded by / Invented by / Date

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TITLE_____ Project No._____

Book No._____

4

Contact Prototype Build Performance Observations

Sample #	Set after straightened (left or right) Angle	REACH (mm)	Secondary Curve Tip offset (degrees) from Primary Curve Length	Approx Angle (left or right)	Secondary Distal Curve Angle	Comments
10 A	13° Left	81 MM	10°	Right offset (3.4mm)	140°	
2 A	11° Left	56 MM	5°	RIGHT OFFSET (1.2mm)	~~155°~~ 140°	
12 B	11° Left	90 MM	20°	Left offset (4.1mm)	~~360°~~ 165°	EXPOSED WIRE
1 B	12° Left	60 MM	5°	Left offset (.6mm)	135°	
12 A	10° Left	103 MM	4°	Left offset (1.1mm)	90°	PIN STOP ADJUSTED DISTAL ANGLE NOW = 143°
6 B	9° Left	93 MM	8°	RIGHT OFFSET (1.2mm)	125°	
7 B	15° Left	57 MM	5°	Right offset (.8mm)	~~325°~~ 90°	PIN STOP ADJUSTED DISTAL ANGLE = 125°
2 B	20° Left	55 MM	26°	Left offset (5.7mm)	125°	
5 B	20° Left	106 MM	25°	Left offset (4.8mm)	125°	
5 A	15° Left	102 MM	4°	Right offset (1.3mm)	133°	
1 A	9° Left	62 MM	20°	Left offset (4.1mm)	115°	PIN STOP ADJUSTED DISTAL ANGLE = 140°
9 A	14° Left	76 MM	28°	Left offset (8.6mm)	90°	
7 A	27° Left	58 MM	17°	RIGHT OFFSET (3.4mm)	90°	
4 A	5° Left	78 MM	0°	(0.0mm)	130°	
8 A	10° Left	53 MM	10°	Left offset (1.8mm)	170°	
8 B	12° Left	56 MM	15°	Left offset (3.37mm)	140°	
3 B	15° Left	83 MM	22°	RIGHT OFFSET (4.5mm)	115°	PIN STOP ADJUSTED DISTAL ANGLE = 132°
4 B	5° Left	75 MM	4°	Left offset (.8mm)	180° +	
11 A	7° Left	101 MM	5°	Left offset (1.4mm)	90°	PIN STOP REMOVED DISTAL ANGLE 125°
9 B	6° Left	80 MM	32°	RIGHT OFFSET (5.9mm)	90°	PIN STOP REMOVED DISTAL ANGLE 130°
10 B		75 MM				

TITLE Design Review Notes

Project No.______
Book No.______

From Page No.___

~~Observations of catheter after torture & direction~~
Design Review Notes

Recommended curve sizes: 55mm, 70mm, 85mm
(85mm) may not go with first round of release

60, 75 mm also work on 85 mm
another possibility — go to extremes

Final Word. 60 ~~55mm~~, 75 mm, 85mm

Comments on primary curve tubing, curve size.

2B: hard to pull, but not impossible — wire starts to bulge thru (does not come thru) at > 180. 180° is max curve for this.

9B: 270° is no problem — curve feels a little flimsy
4B: will go 270° — curve stiffness feels good
7A: curve feels good — will go to 270°
2A: same as 2B
5B: a little flimsy — will pull to 270°
3A: ~~a little flim~~ pretty good — could be stiffer. — will pull to 270°
12A: too flimsy will pull to 270°
10A: a little flimsy — will pull to 270°
1A: pretty good stiffness — will pull to 270°
6B: pretty good — could be stiffer
8B: good stiffness, 270° can be pulled, but wire starts to bulge thru 180° is no problem though.
11A: very flimsy, 270° can be pulled

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Witnessed & Understood by me,

Invented by John Farah

Recorded by

Date

TITLE Band loading/welding/Swaging Contactr Project No.____ Book No.____

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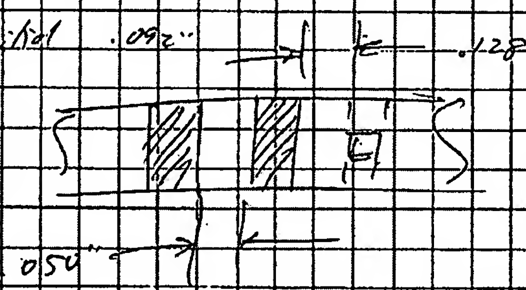
Band loading/welding/Swaging – Contactr

Initial



.092" will swage good
on intermediate tubing –
no wrinkling, stays in place,
no twisting
↳ will use .091" ID
Note: need to go slowly in
swaging die

Pull Force .7597 (180° pull)
.9986 (0° pull)
.9584 (0° pull)

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Witnessed & Understood by me,

Invented by John Lamb

Recorded by

Date

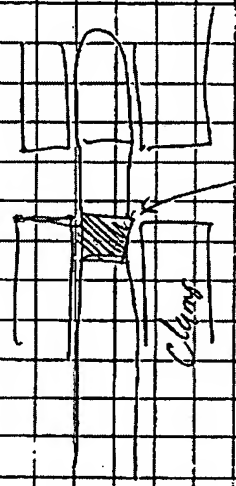
Project No.

TITLE Sprinkler Tip Fusing Qualification Book No. 10363

From Page No.

Sprinkler Tip fusing qualification

Added rework tip learned during qualification



Line up bevel with the edge of the clamp and recycle fusing machine

To Page No.

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Invented by John Frost

Recorded by

Date

TITLE Slider ring pull distances - Contacts   Project No.____   Book No. 10363

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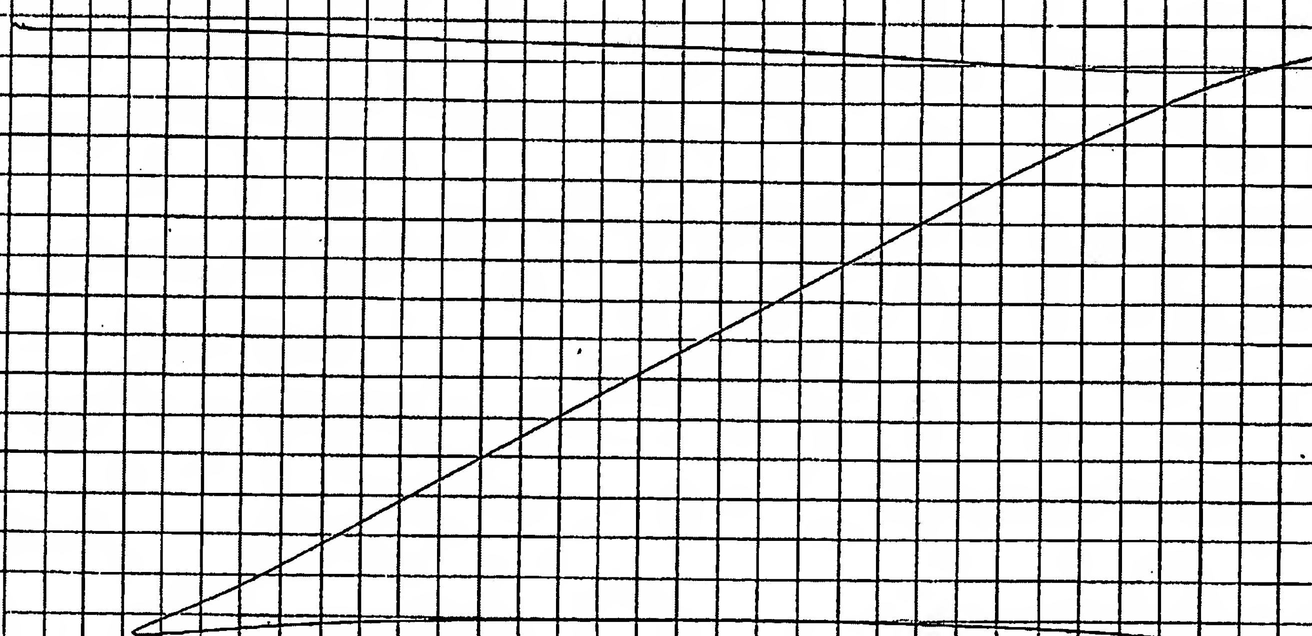
Slider Ring Pull Distances.   Units in inches

Model	Proximal (Tip 270°)	Distal (Tip 135°) (when straight)
588C	.530 — .180	.588 — .031
575C	.540 — .174	.583 — .101
588B	.491 — .176	.543 — 0
465A	.536 — .117 (not quite 270°)	.563 — .100
~~465~~ 575A	.539 — .137	.580 — .100
468B	.530 — .107	.569 — .150

1.757 — .100 — .275

~ 1.00"



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Witnessed & Understood by me,   Date

Invented by   Date

Recorded by

Project No._____

TITLE Strength expected at anchor joint Book No._____ 9

From Page No.___

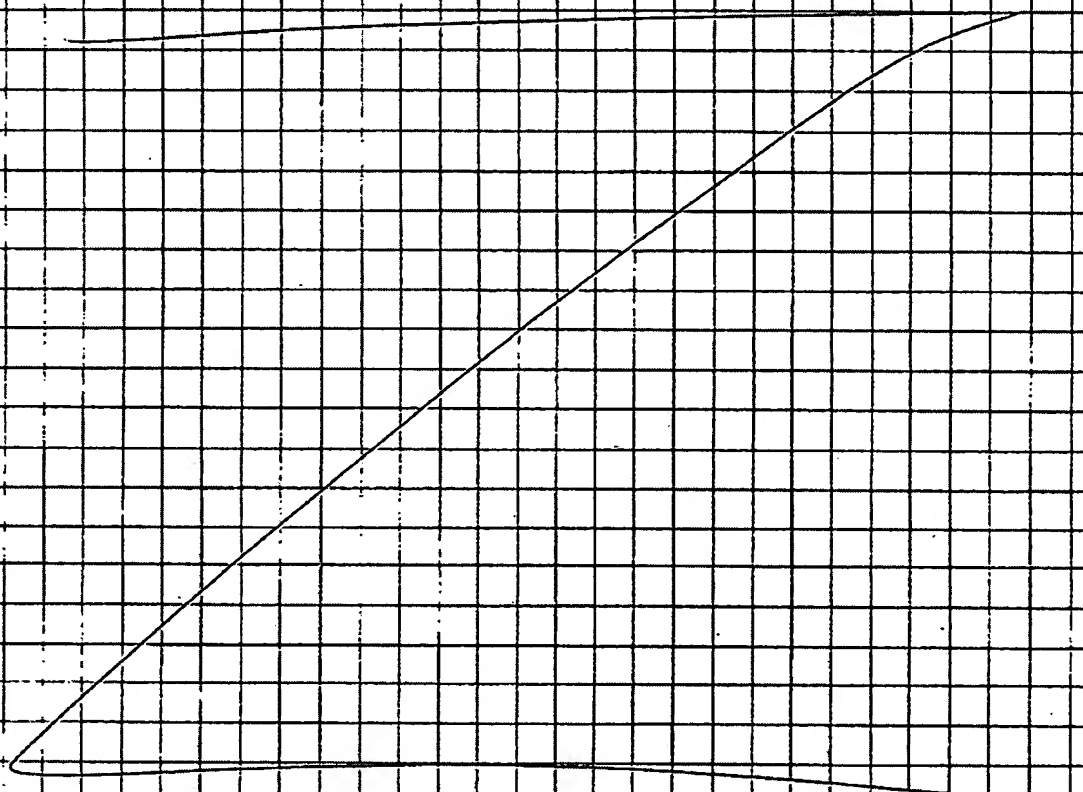
Pull strength of for tubing 170411-001 350 Pebax dual lumen.

Tubing strength alone (no case, no anchor)

Gauge length: 2.00" Pull rate: 2.00"/min

1	10.00	extension stopped when tensile force = 10.00 lbs.	
2	15.54	14.65	gauge length 1.00"
3	15.22	13.60	gauge length 1.00"
4	16.22	14.03	gauge length 1.00"
5	15.76	14.68	gauge length 1.00"
6			gauge length 1.00"

Load ↑ Extension →



To Page No.___

Witnessed & Understood by me, Date

Invented by John Lamb Date

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Project No._____

TITLE Dielectric Strength Testing of wire Book No._____

From Page No.___

Test of catheter w/ salted test solution
1 minute: 1.50 kv., .500 4 mA trip.

Catheter	60-8	.41 high.	(pass)
	575A	.35 high	(pass)
	468A	.32 high	(pass)
	60-5	.30 high	(pass)
	EPT Blazer II	.52	(fail)
	503/TM Lot 5K108		
	EPT Steerwath	.35	(pass)
	Daig Guidewire II	.12	(pass)

10 second rise, 10 second dwell

Wire:	Daig green	2 KVDC	no leaks
		2 KVAC	.13 mA
		3.0 KVDC	no leaks
		3.5 KVDC	no leaks
		4.0 KVDC	no leaks

152981-001
GM

To Page No.___

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	

TITLE Hot Knife Uniformity Study

Project No.

Book No.

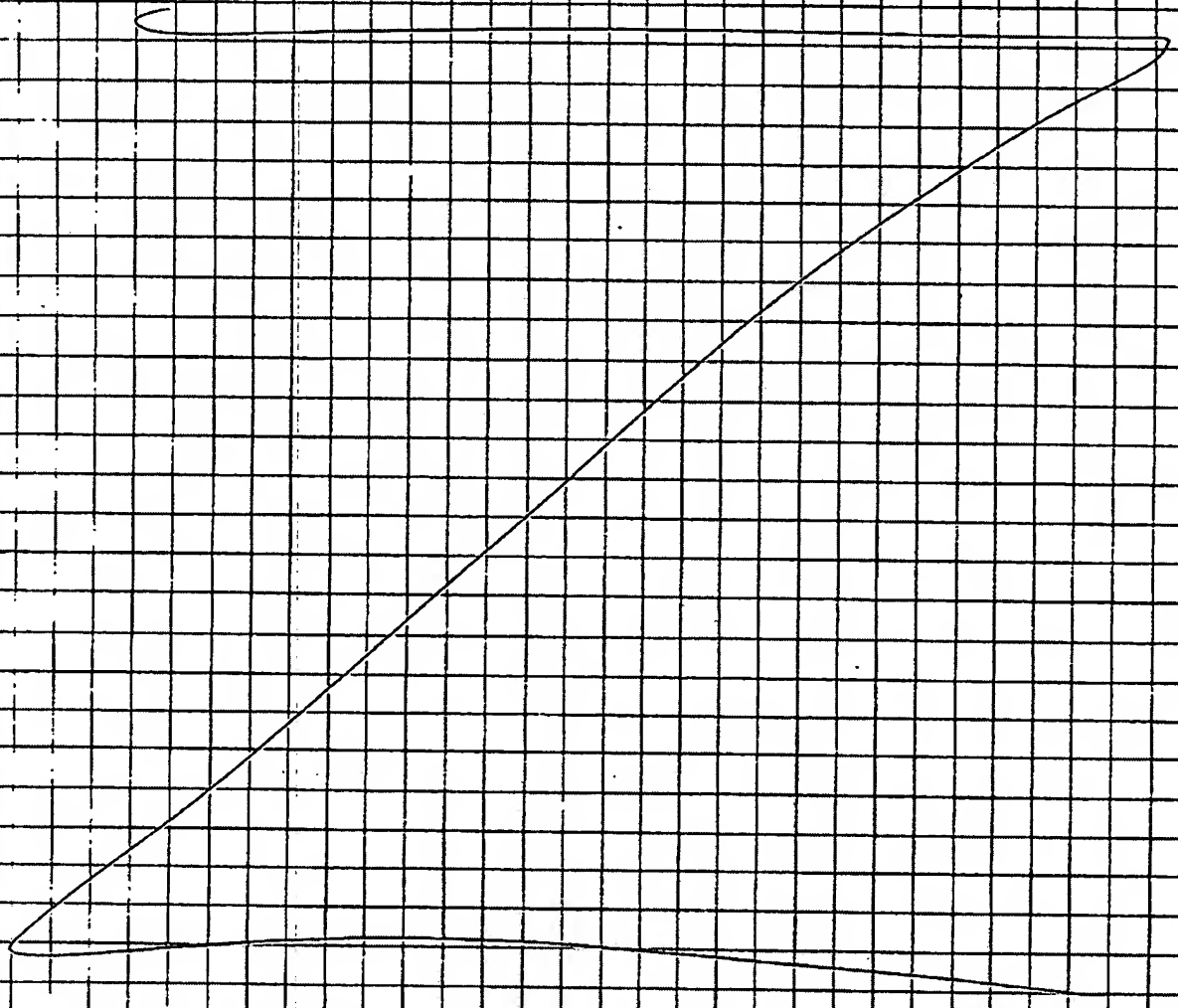
From Page No.

Machine: ES18482

Temperature Setting: 500°F, 25 SCFH

Temperature reading, old Thermocouple: 457.3
(Max temp read)

Temperature reading, new Thermocouple: 462.9
(Max temp read)



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Witnessed & Understood by me,	Date	Invented by John Lamb	Date
		Recorded by	

TITLE Contact Tip Fusing - SLP. Project No. Book No. 12

From Page No.

Machine used: ES1848-2

Parameters:

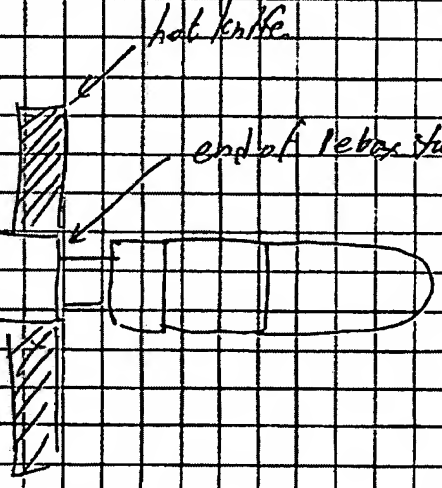
Heat Timer	Slide Advance	Air Cool	Total time
40 sec	20 sec	45 sec	60 sec

Max vel	.005 in/sec
Move	~~-.005~~ -.083 in
Wait	40 sec
Home at	0.1 in/sec
Wait	0 sec
Max vel	.025 in/sec
Move	-.300 (4 mm)
Wait	0 sec
Program End	

Airflow: 20-25 SCFH
Temp: 380°F

All Good RESULTS

Program 2 → 4mm
Program 3 → 5 mm
Program 4 → 8 mm



Note: ES1848-2 is about 15°F higher temperature setting than R&D lab

ie.:

ES1848-2	R&D
380	365

Hot knife reading (highest reading) = 350-354°F

To Page No.

Witnessed & Understood by me, Date

Invented by John Smith Date

Recorded by

From Page No.

Evaluation of Out of Plane Deflection On Contact Proximal Curve

Some collectors sent out for stress analysis

(1) 75-SA Proximal Curve EXACTLY IN-PLANE
Distal Curve a little crooked

(2) ZD Proximal Curve in-plane
Distal Curve a little to left (SA)
Distal Curve has four extrapolations

(3) 60-4 Proximal Curve in-plane a little to left - one tip wide
Distal Curve in-plane

(4) 60-8E Proximal Curve a little to left - one tip wide
Distal Curve in-plane

= all collectors came back from stabilization fixture stand

To Page No.

From Page No.

① Butt splice
Crimp
Contact 400
Hybrid

mandrels .011, .024, .024
Temp: 425-430
air flow: 20-25 SCFH
Heat time: 65 sec 15-10 10/19/21
Compression Delay 75 sec
Cool time: 30 sec
Air pressure 30-75 PSI
Throat block: .195
140

— .018" for crimp diameter.

— 364°F for hip fuse

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	

Project No._____

TITLE Blood coagulation comparisons Book No._____

From Page No.___

Purpose: to evaluate the difference in blood coagulation when using Daig, Cordis, & EPS catheters to ablate in thermocouple feedback mode (temperature control)

First set 65°c, 50w power limit

(1) Daig

(2) EPS

(3) Cordis

3 pictures taken

Second set 65°c, 50w power limit

(1) EPS average power 13w, max power 16w.

(2) Cordis average power 14w, max power 16w.

(3) Daig average power 11w, max power 13w.

3 pictures taken

Third set 70°c, 50w power limit

(1) Cordis avg power: 17w max power: 23w

(2) EPS avg power: 13w max power: 22w

(3) Daig avg power: 13w max power: 18w

To Page No.___

Witnessed & Understood by me,

Date

Invented by John Stark

Recorded by

Project No.

TITLE 8 mm tip snap - Conductr. Book No. 16

From Page No.

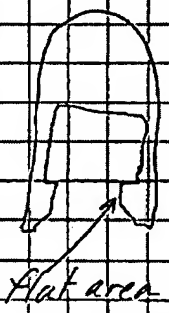
① Comparison of tip snap of Conductr insulator with Contactr insul

Conductr		Contactr	
P/N tip	P/N insul.	P/N tip	P/N insul.
120168-004	153595-001	120168-004	177343-004
Lot 705554	Lot 721606	Lot 705554	Lot 720144

① Good - slips thru ring gage
② Good - slips thru ring gage
③ Slight flare - goes thru ring gage with slight friction

① Flared tip edge friction thru ring gage
② Slightly flared tip edge
③ Good - slips thru ring gage

Conclusion: although the design of the ledge inside the tip electrode (flat area) may contribute to the flaring of the tip, the insulator is most likely the reason for the difference among the crapped assemblies.



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Witnessed & Understood by me, Date

Invented by John Fork Date

Recorded by

Investigation of ~~5mm~~ Conductr 5mm & Project No.

TITLE 8mm tip snap. Book No. 10363

From Page No.

Objective: Examine the possible difference between Contactr insulator 170343-004 & Conductr insulator 153595-00? that affects their functionality with 5mm tip 120181-004 and 8mm tip 120168-004. Also examine any possible lot differences or combinations that could affect the fit of the insulator and tip electrode components.

Tip 120181-004 Lot 732812
Insulator 170343-004 Lot 720144
↳ snap feature large diameter: .081" w/ quadrachek toolmakers scope .0813

① w/no adhesive - the probe snap feature breaks over
② w/ adhesive - tip snapped over insulator without breaking the snap feature

Tip 120181-004 Lot 732812
↳ conductr.
Insulator 153159-001 Lot 720608
↳ snap feature large diameter: .080" w/ quadrachek toolmakers scope .0803

① w/no adhesive - the probe will snap over the insulator without breaking over the snap feature.

Tip 120181-004 Lot 681238
Insulator 170343-004 Lot 720144

① w/ no adhesive - the probe snap feature breaks over, but not as much.

Patrick brought up a good point: w/ adhesive, the tip could be maintained against the insulator edge.

Note: tip snap feature is sticking with new lot of tips.

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Witnessed & Understood by me,	Date	Invented by John Cook
		Recorded by

From Page No. 17

Tip Measurements:

5mm tip ~~120815~~

120181-001 Lot 732812 — will fit .074- all the time and .075- some of the time (depending on piece part)

120181-001 lot 681238 — will fit .075- gage pin all of the time.

8mm tip

120168-004 lot 705554 ——— will fit .074- all the time and .075- some of the time (depending on piece part)

(w/ insul 120743-004 lot 719583)

To Page No.

Witnessed & Understood by me,

Date

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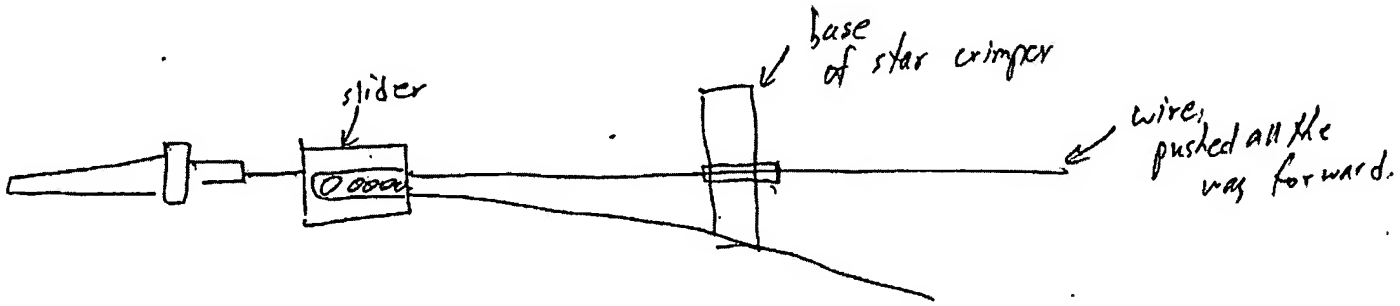
D.

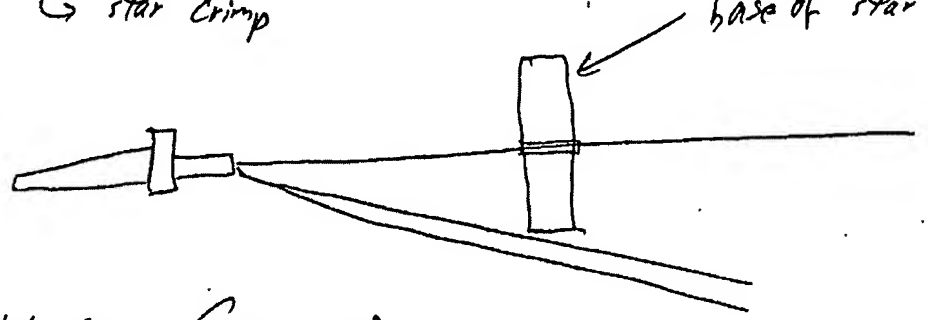
Slide Wire Crimping

↳ star crimp



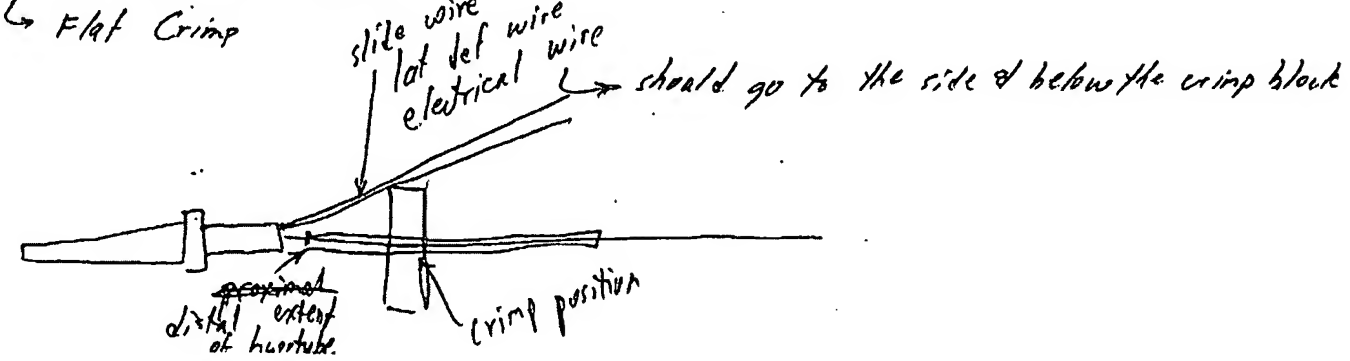
lateral deflection wire hypotube crimp

↳ star crimp



Distal Crimp (Pull wire)

↳ Flat Crimp



From Page No.

Pinion w/ adhesive 31.65 lbs
Pinion w/o adhesive 12.01 lbs.

(1) Cut tips to 17 cm ± .5 cm
(2) Fuse tips
- Mandrels — Teflon: 2.5 cm
.012", .023", .027" x .027"
- Parameters
430°F 20-25 SCFH 130 Throw
Heat 65 sec Press Delay 10 sec Cool Time 30 sec
(3) Cut tip to length, Cut shaft to length
120 mm Total 114 cm
(4) Fuse strain relief on shaft
or glue.
(5) Prepare tip
→ cut tapered wire to length (need a fixture for this)
→ thread tapered wire thru tip, insulator, head (2310 blade)
→ thread half-ended wire thru tip insulator
→ apply glue to inside of tip and snap on (need a fixture for tip snap.)
(6) Thread tip and associated wires into catheter shaft
(7) Thread slide wire into catheter for distal end.
Pull wire back from tip a little
(8) Fuse insulator into tip tubing need a fixture for this
→ done manually - temperature is 360°F.
(9) Crimp proximal pull wire hypotube onto pull wires
(10) Crimp lateral deflection hypotube onto lateral deflection wire
→ two crimps .028"
(11) Crimp pull wire slider on
(12) Crimp slide wire hypotube on. Put slider on and bend (need fixture for bending)

Note: for electrically active selector, cut polyimide .0225 x .028 to 10.5 cm ± .1 cm

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TITLE Documentation of Ablation with elec active tip.

Project No.______

Book No.______

From Page No.___

(1) Put polyimide sleeve into large lumen:
.0225 X .0285 length: 10.5 cm ± .1cm

(2) slide slide wire into large lumen beside the ~~pebit~~ polyimide
Tape the ~~two wires~~ polyimide and the slide wire together at their distal ends with thin (width) tape – This will keep the polyimide from slipping into lumen.

(3) load band into polyimide and cut proximal end

(4) put 1st deflection and pull wire into insulator and the slide wire into catheter. – the wires must slide thru band. Make sure wires (mechanical & electrical) are aligned with the tubing (not twisted or crossed)

(5) load electrical wire and tip thru insulator and into polyimide wire must go thru band.

(6) ~~fire~~ glue of snap tip to insulator

(7) remove tape from around polyimide and slide wire & push them into tubing.

(8) Fuse tip

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Witnessed & Understood by me,	Date	Invented by	Date
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From Page No.

add 20 mm → tip length 140 mm
untapered wire length 100 mm
crimps of slide wire is 20 mm proximal

add 30 mm → tip length 150 mm
untapered wire length 110 mm
crimps of slide wire is 30 mm proximal

add 40 mm → tip length 160 mm
untapered wire length 120 mm
crimps of slide wire is 40 mm proximal

add 70 mm → tip length 190 mm 150
untapered wire length 220 mm
crimps of slide wire is 70 mm proximal

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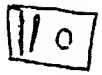

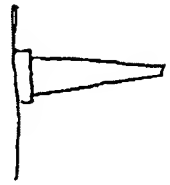

From Page No. Selector.

Irrigated Emitter – 5 curve

Fusing Block for Butt Joint: .140

Total length of deflectable tips = 165 mm

Sample #	Intermediate Length (mm)	Tip Length (mm)	Shaft Length (cm)
(1) -22	115mm/55D	50mm/55D/40D	98
(2) -22	125mm/55D	40mm/55D/40D	98
(3) -22	135mm/55D	30mm/55D/40D	98
(4) -22	145mm/55D	40mm/40D	97
(5) -22	110mm/63D	25mm/40D	
(6) -22	135mm/63D	30mm/40D	
(7) -22	140mm/55D	25mm/40D	
(8) -22	135mm/55D	30mm/40D	

110/135 25/30

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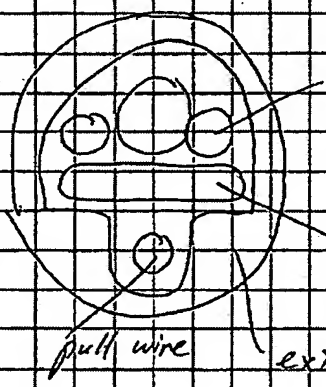
Project No.

TITLE Bending Beam — Book No. 10363 — 23

From Page No.

Cross section

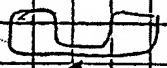


side view – could have molded taper

– could have molded features

Bending beam is a polymer material – can be molded or cut from sheet. Preferably high durometer material such as ultem (PEI). Advantage – polymer can be molded or easily formed to a tapered shape (thickness or width). Beam can have molded-in features to capture wires or hold other mechanical components in place

– Variation on bending beam – bending beam with a fluid tube

bending beam general shape:  (cross-section)

thin web

bending beam bonded with fluid lumen:

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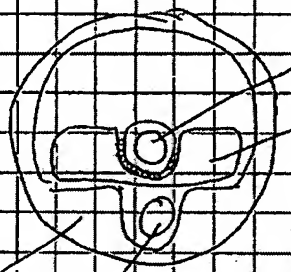
Witnessed & Understood by me,

Invented by

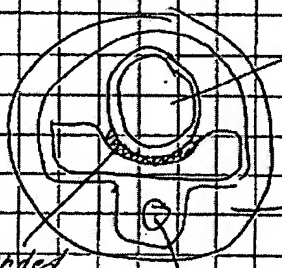
Recorded by

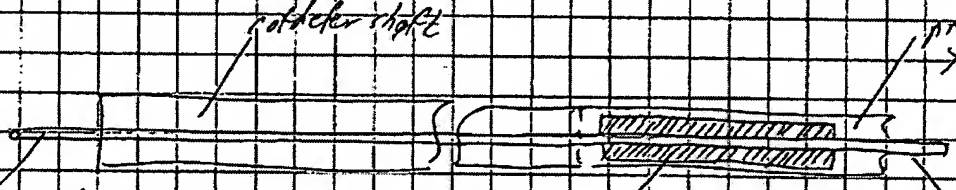
From Page No. 23

Fluid tube beam in catheter examples:



& larger fluid tube possible





beam can be adhered to tubing in specific areas only

single lumen tubing (one extrusion, unjoined) can pass thru catheter, and beam can be attached where necessary.

To Page No.

Witnessed & Understood by me

Stanton Hoon

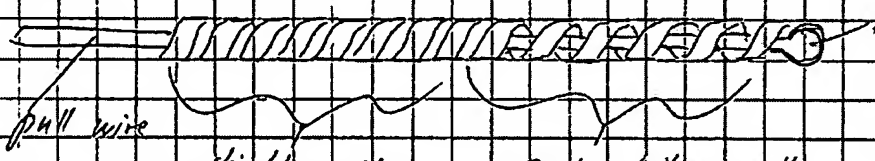
Invented by John Lenk

Recorded by John Lenk

Project No.

TITLE Cheesecutter prevention & wire anchoring. Book No. 10367

From Page No.

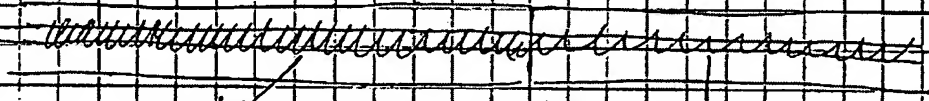


tight wound coil wound area of coil

Spacing between coils (like a spring)

Tight wound coils are positioned inside shaft area that is not intended to be actively deflected with a pull wire.

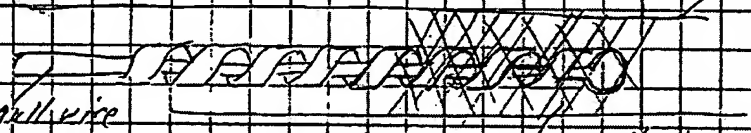
Spaced coils are positioned inside shaft/tubing area that is intended to be actively deflected. The spaced coils allow compression. Unlike the spaced coils are in a soft deflectable tubing, the coil "adds diameter" to the wire, helping to prevent the wire from slicing thru the wall of the deflectable tubing. The coil is also a surface for the wire to slide over, preventing a sawing of the tubing by the pull wire.



tight wound in non-deflectable shaft

spaced in deflectible hip tubing

The spaced coils, in combination with a ball on the end of the pull wire, provide a good way to anchor the distal end of the wire, which is needed for deflection reasons.



The spaced coil helps this anchoring because it provides many hard edges and spaces to capture with the adhesive. The ball end on the wire prevents it from slipping thru the coil.

To Page No.

Witnessed & Understood by me,

Invented by John Funk

Recorded by John Funk

Date

Project No.

TITLE Book No. 26

From Page No.

Irrigated Selecty -5 curve - 7 lumen
Prototype Build.

Butt Joint Fusing

mandrels: .024" x 2, .078"
temp: 430°F
heat time: 60 sec
push time: 15 sec
cool time: 30 sec
heat block: .150"

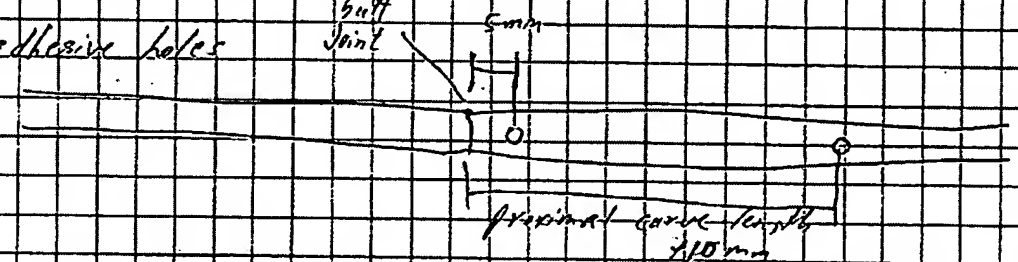
Catheter Configuration:

	Proximal Curve Length	Distal Curve Length	
1-26	175	25 30	170
distal pulls proximal, flat wire length 133, curves toward			
2-26	175	25	160
distal pulls distal, flat wire length 133, curves away			
3-26	110	35	145
distal pulls proximal, flat wire length 108, curves toward			
4-26	110	25	135
distal pulls distal, flat wire length 108, curves away			

Flat wire welding

.002" x .055" flat wire — Pulse 1: 3.0% — Polarity: [+]
Unitek 250 Dual Pulse — Pulse 2: 0% — width: short

adhesive holes



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Witnessed & Understood by me, Date

Invented by John Smith Date

Recorded by

From Page No.

S-curve prototype Characteristics

Serial #	Overall Length	Deflectable Tip Length (Primary)	Deflectable Tip Length (Secondary)	Comments
27-1	85 cm	14mm	25 mm	Distal tip length from end to ball on proximal pull wire. No radiopaque band. Distal coil not anchored at butt joint. Distal end of bending beam not anchored.
27-2 gave to Scott	85 cm	113 mm	37 mm	
27-3	85 cm	120 mm	30 mm	
27-4 gave to Scott	85 cm	125 mm	25 mm	

Single curve flex tip prototypes

			Soft tip length	
27-5	85 cm	110 mm	13 mm	Soft tip material: Pellethane 55D .035x.014
27-6 gave to Scott	85 cm	128 mm	13 mm	
27-7	85 cm	126 mm	18 mm	
27-8 gave to Scott	85 cm	112 mm	18 mm	

To Page No.

Witnessed & Understood by me,

Date

Invented by John Smith

Recorded by

D

Project No._____

TITLE _____ Book No._____

From Page No.___

Forcing Mandrels for T-lumen single curve Selectors.

.010", .051"

Witnessed & Understood by me,	Date	Invented by
		Recorded by

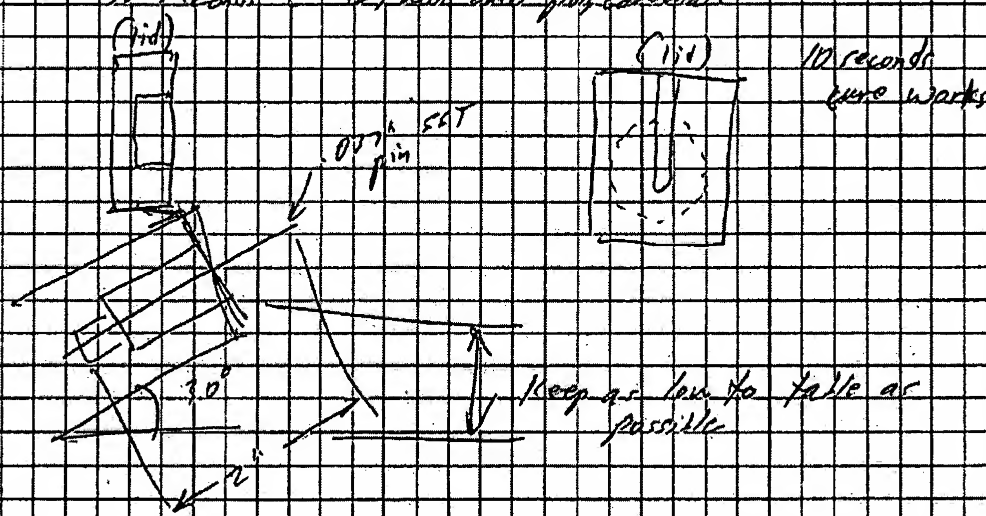
Project No.
TITLE UV curing Precil Hub fixture
Book No.

From Page No.

UV system – The Lure power 7.07 W/cm²

Accu-Cal 20 UV intensity meter

50 seconds (5AD) will burn polycarbonate



To Page No.

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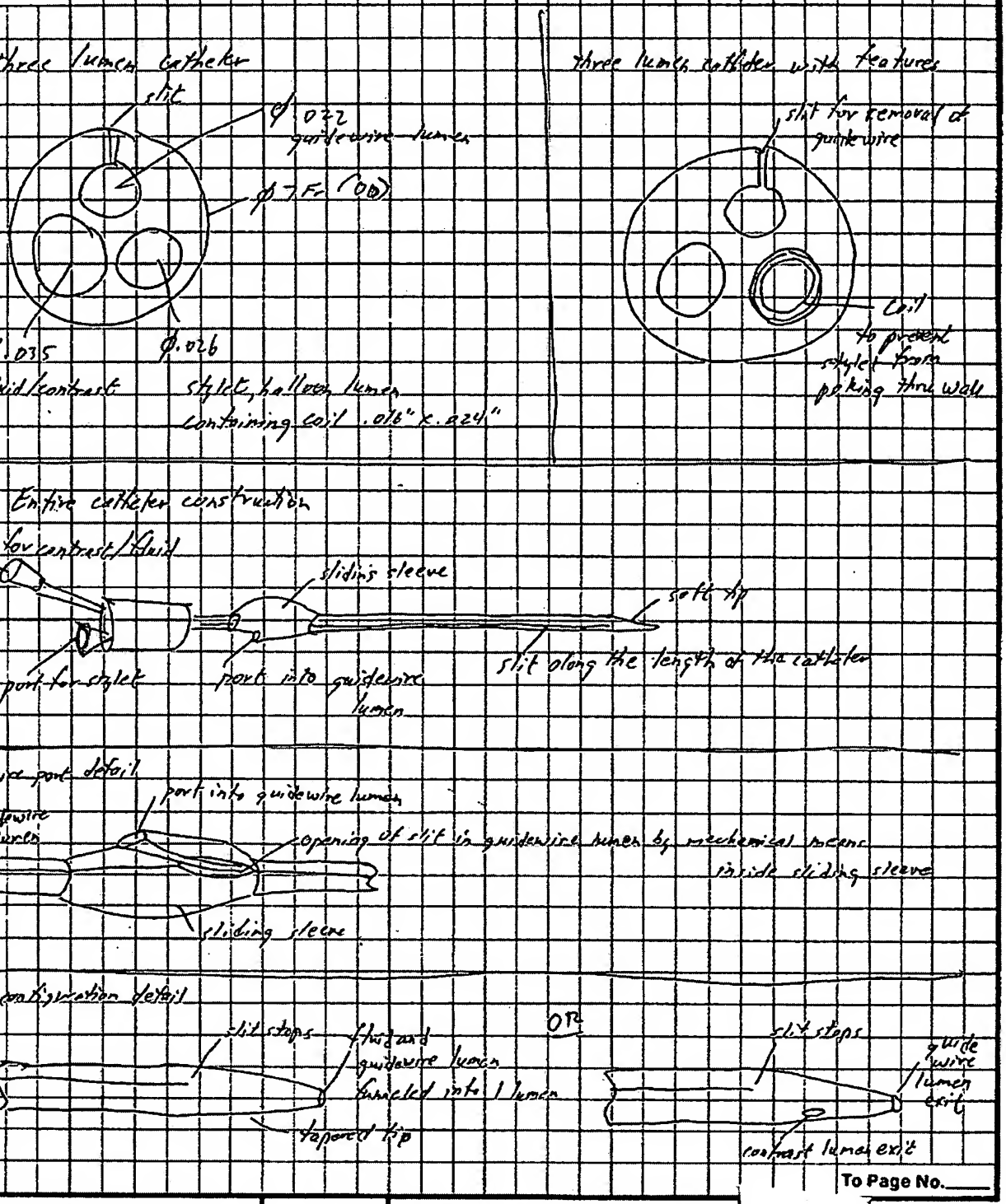
Project No. B4429

TITLE Guidewire delivery Catheter. Book No. 10363

From Page No.



To Page No.

Witnessed & Understood by me,

Invented by John Lost

Recorded by John Lost

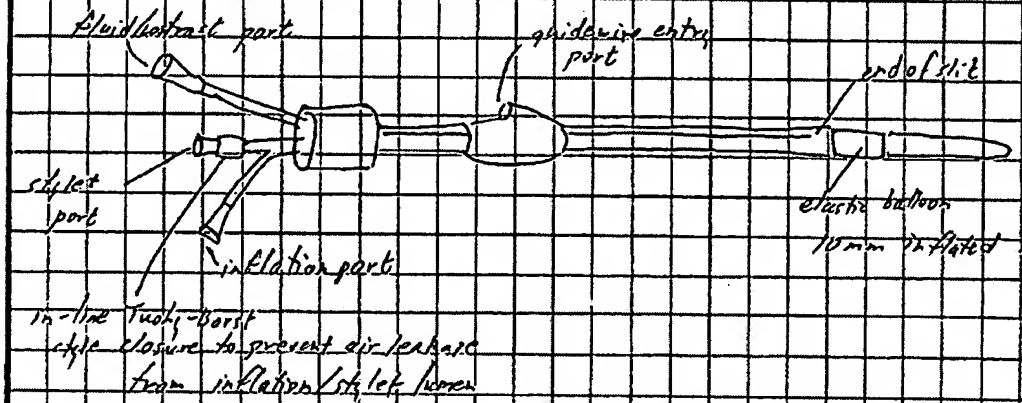
Project No. B4429

TITLE Guidewire Delivery Catheter – Balloon Option

Book No. 10363

From Page No. 30

Balloon would be desirable for the purpose of doing occlusive venograms.



Witnessed & Understood by me,

Date

Invented by John Jorde

Recorded by John Jorde

From Page No.

3 shapes in same package
↳ smaller than typical Angiographic shafts
↳ all have curves distal enough to allow "multiplane movement"

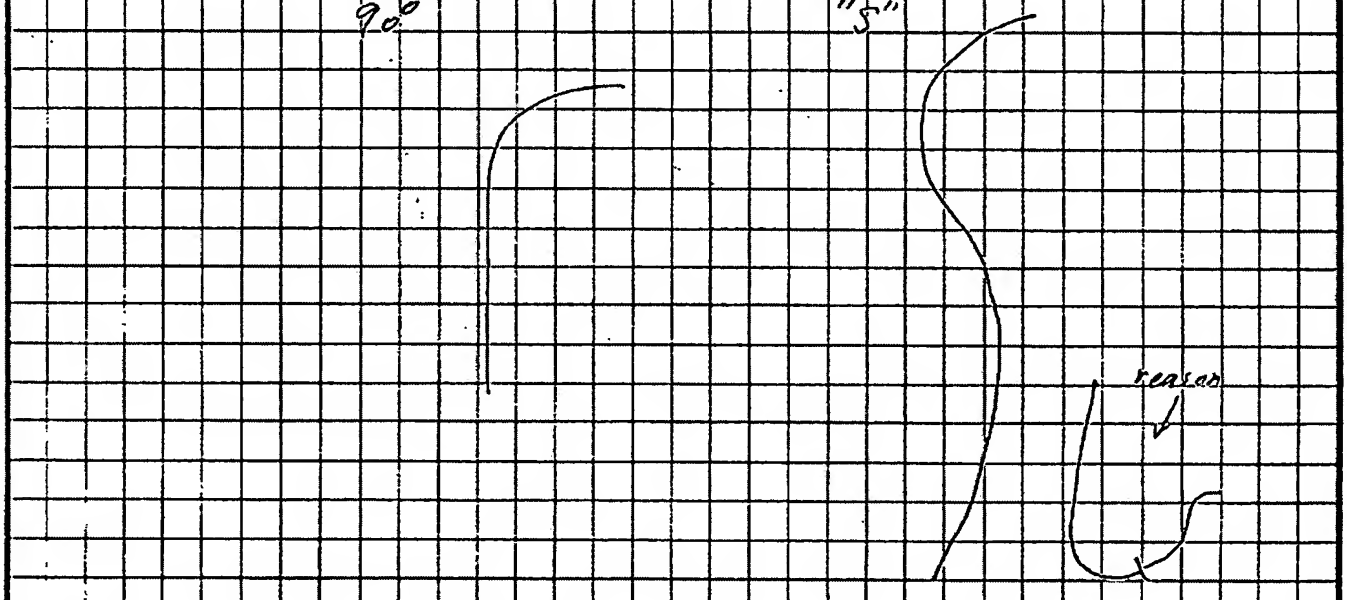
Current Attain Lengths:
Angiate, Multipurpose: 48.5 cm
add ~1cm for hub/valve
Straight: 45, 50 cm
AL + MB1: 40 cm
A MB2: 45 cm
16600: 49 cm

6226DEF: 52 (Total length) 5fr (including valve)

For steerable guides:

Angiographic catheter designs: Sitsec

Diameter	Working length	Shape
6Fr	70 cm	AL2
	70 cm	Internal Mammary Artery
	70 cm	CAS 2 (Cordis shape - Cas Illa)
	70 cm	90° (Defined by me)
Cordis Super Torque 6F CAS 2		S (defined by me)



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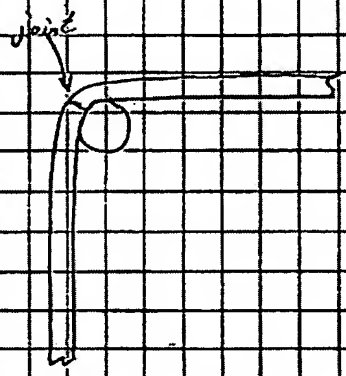
Witnessed & Understood by me, | Date | Invented by | Recorded by

From Page No.

Procedure: Bend joint in 4 directions (approximately 90° to each other) over a .250" rod until distal end of joint is 90° to thigh proximal of joint - shown below.
Repeat for a total of 3 bends and record observations.



Test Unit	Result
33	
49	
47	
46	white stress line - no brittle failure after continued manipulation (3x total)
45	
41	
37	
42	faint white stress line - no failure after 16 manipulations
40	faint white stress line - no failure after 16 manipulations
44	
36	white stress line - no failure after 16 manipulations
38	faint white stress line - no failure after 16 manipulations
35	
30	
32	
39	white stress line - no failure after 16 manipulations
48	
31	
34	white stress line - no failure after 16 manipulations
43	white stress line - no failure after 16 manipulations

To Page No.

Witnessed & Understood by me, | Date | Invented by | Recorded by John Poole

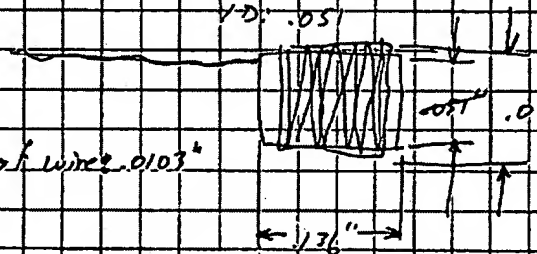
From Page No.

Materials:

(1) 55D Urethane OD .091" ± .001", .006" walls.

(2) 75D Urethane OD .038" ± .001", .004" wall

(3) Coil



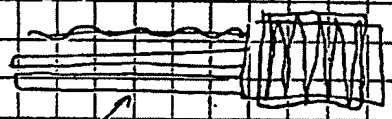
#2 0.19 3688 OD
p/l Rev I 0347

Measured by Kanta Yaeger

(4) Polyimide .012 ± .0005 wall .004
(153547-) Phelps Dodge

(5) Adhesive for coils: Loctite 498 (Cyanoacrylate) 16218-001

Polyimide routing under coils:



Put polyimide on the same side of the twisted pair.

(6) Extension tube: (Ordered from Newark) Spc PVI-SIS-1100-CLR-DUR

OD: .056" ID: .062"

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	

Project No.

TITLE Silicone Valve Investigation Book No.

From Page No.

(#1) Nusil Med 4195 Wipe mold of York with 094369-001
(Spray onto tooled of wipe)

Injection Pressure 2000 psi
Plate Temp: 302 °F
Plate Pressure: 2000 psi

News processing conditions: Injection: Dayton 42328D 1 Ton Arbor Press
Plate Temperature 325°F
Cure time: 3 min
Plate pressure: 2000 psi.

To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	

Project No._____

TITLE Forming Lead Nav Insert Tip Book No._____ 36

From Page No.___

Mold

PEA - drilled with 3/32" dia. ball end end-mill

.030 mandrel Teflon coated

PTFE tubing (to create a step down

ID: .079" ± .002"

Wall: .0075" ± .0015"

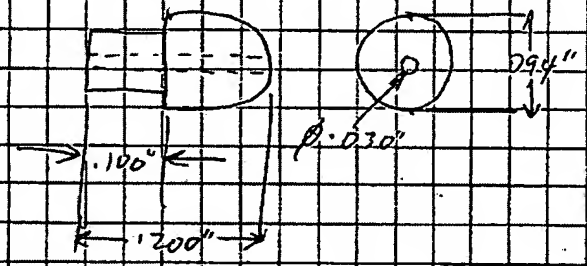
Part Result:

Material: Cardio Rhythm EX-1652 1-3-96

00711 Atochem Rebax 3533 SN00 or SN101

20% Barium sulfate 2% Reed Blue Concentrate

cPUR02444 and 1% TiO2



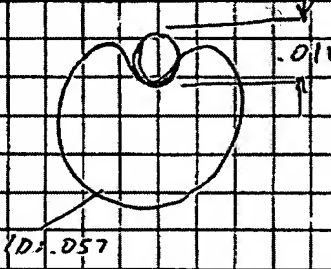
Put ~~.030~~ .028" mandrel into inner tube before bonding with urethane solvent adhesive

To Page No.___

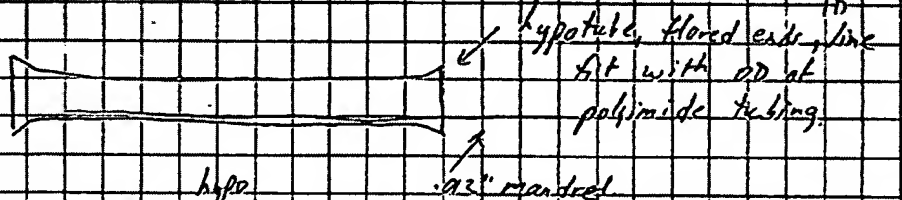
Witnessed & Understood by me,	Date	Invented by John Lunde	Date
		Recorded by	

From Page No.

Objective: Form a liner with a channel that will accomodate a .010" wire



Method:



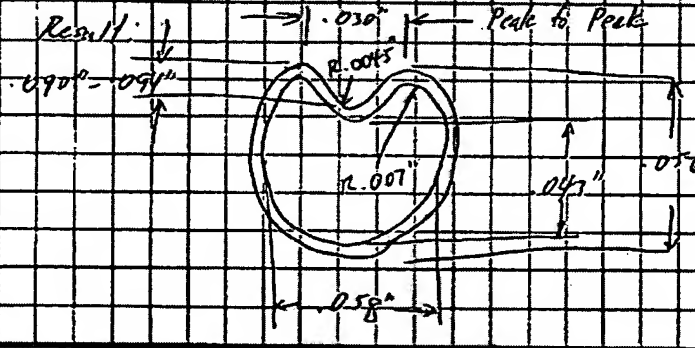
① Push mandrel into hypo tubing, then polyimide tubing. .032" needed to support polyimide when pushing into hypotube

② Heat hypotube to 750°F. Use Leister Hot Air Soldering Station Type Hot Jet "S" Digital Leister GH-605b

③ Cool with factory air.

Also, in step 2 pull on mandrel after placing polyimide to make channel more straight along wall (reduces "candy cane" effect).

Result:



Tubing: Rheps Dodge
Polyimide .059" ID
.062" OD

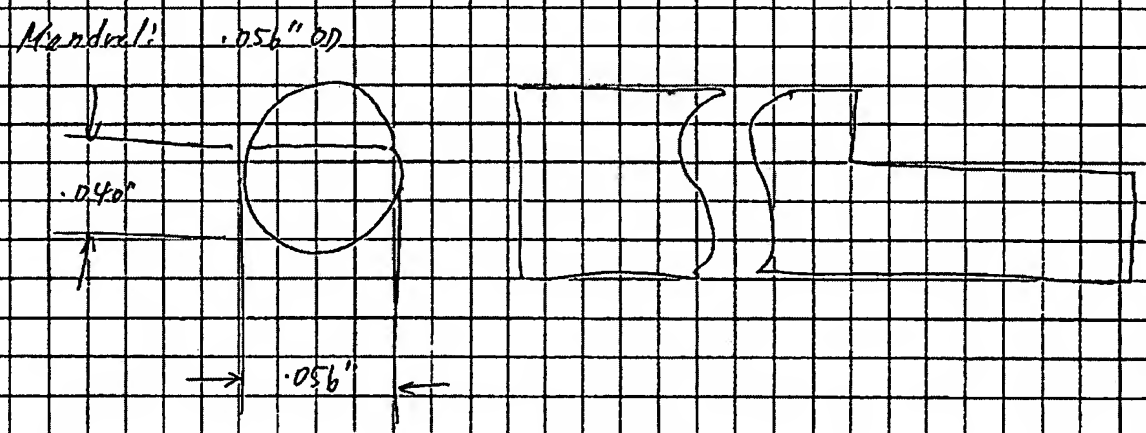
To Page No.

Witnessed & Understood by me, | Date | Invented by | Recorded by

Project No._____

TITLE_____ Book No._____

From Page No.___



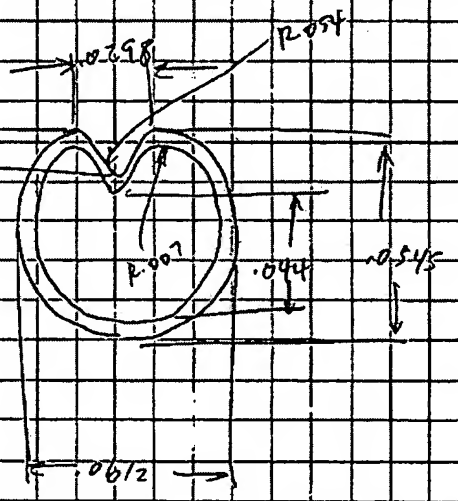
To Page No.____

Witnessed & Understood by me,	Date	Invented by
		Recorded by

Project No._____

TITLE Lead Mass Channel Liner Book No._____

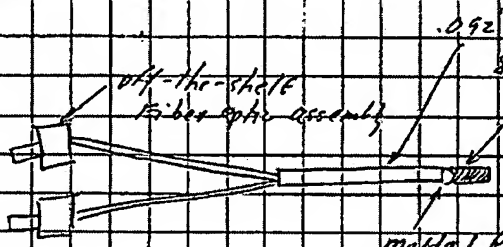
From Page No.___



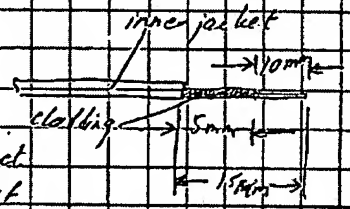
To Page No.____

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	

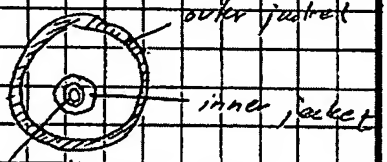
From Page No.



Materials



Tip assembly:

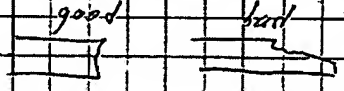


① Cut outer sheathing/jacket away from inner jacket with a razor blade. Be careful not to nick inner jacket. Strip about 85 cm length.

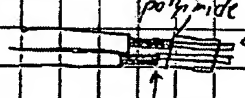
② Strip inner jacket using Micrestrip .035" hole x .021" blade - strip length: 15 mm.

③ Strip cladding using Micrestrip .021" hole x .012" blade - strip length: 10 mm.

④ Break the end (very tip) of the fiber optic with sharp snips - end of fiber optic should be cut so that long chips or slivers do not go down the length of the fiber optic.



⑤ Cut a 5-6 mm piece of polyimide (polyimide .017" ID x .022" OD) and slide polyimide over the fiber optic. The fit is snug and it may be best to make the edge of polyimide a little oval by compressing with tweezers.



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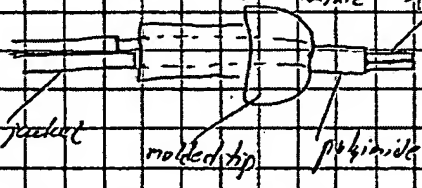
Witnessed & Understood by me,	Date	Invented by John Funk	Date
		Recorded by John Funk	

From Page No. 40

First clean molded tip with Isopropyl alcohol and a wipe.

(6) Push molded tip over polyimide and fibers and up to nearest end of inner jacket



note: measure from the end of fiber optic to lip of molded tip length.

(7) Fill a piece of PTFE tubing (.085" x .118", 4" long) with DP420 Black Epoxy. Using static mixer and dispensing gun, dispense epoxy directly into PTFE tubing

(8) Push assembled tip into filled tubing so that epoxy covers the end of the tip and the optical fibers. Take care to push while excluding the open end of the PTFE with finger. Stop pushing when adhesive flows (just barely visible) from the proximal end of the molded tip

(9) Let assembly cure for 24 hrs. Note: accelerating the cure with heat causes bubbles to grow larger (not good)

(10) Roll PTFE (slice & peel) away from cured adhesive - leaving an measurement made in step 6, cut Epoxy and then rough sand to optical fibers.
Note: to see optical fibers during rough sanding, must wet the sanded end. Also, can shine light down the proximal end of the fiber. If bubbles are present, sand thru the bubble to remove them.

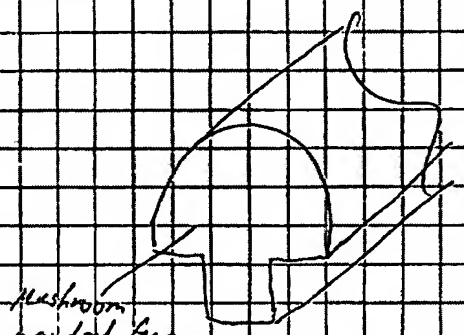
To Page No.

Witnessed & Understood by me, | Date | Invented by John Lord | Recorded by John Lord

Project No.

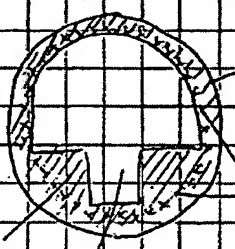
TITLE Braided Mushroom Tumer Tubing Book No. 42

From Page No.



mushroom mandrel free

① Spray mandrel completely with Slide Silicone Mold Release
② Use pre-braided braid. Stretch over mandrel and twist ends of braid.
③ Slide polymer jacket over the braid/mandrel
④ Fuse the polymer jacket into the braid by sliding FEP heat shrink over the entire assembly and heating.
⑤ Remove the mandrel after fusing.
⑥ Cross section of the finish assembly should look like:



note: polymer should fill in indents around "stem" of mushroom shape

Tumes with mandrel removed

Try these materials: Pebax 40D.
.002" braid
.005" braid (if available)
polymer braid.

To Page No.

Witnessed & Understood by me. Date Invented by John Lamb Recorded by John Lamb

Project No.

TITLE Peelable Hub — Book No. 1036 — 43

From Page No.

PURPOSE: To create an access point to the shaft that does not go thru the hub transition point.

#1 & #2 peel down the axial length of the hub. Top tab is pulled or manipulated to initiate tear and a strip is removed

Tear tab

tear "lines"

#1

#1 & #2 are different only in the style of the top tab.

#2

tear lines

#3 peels circumferentially around the hub - full access from the proximal end of the hub is not created - but the transition point is removed.

#3

tear line (circumferential)

#4 creates access from the proximal area of the hub to the shaft - no material is removed.

#4

split/tear line

To Page No.

Witnessed & Understood by me,

Brian B

Invented by John Hunter

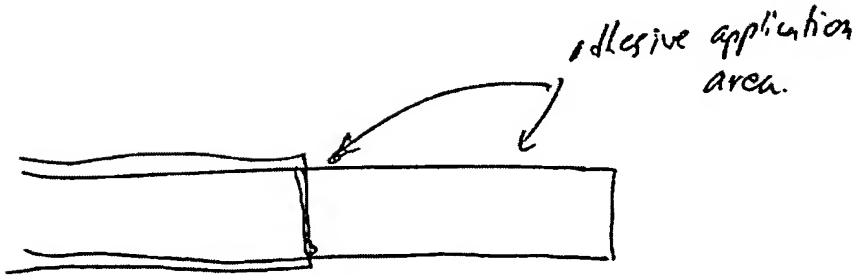
Recorded by John Hunter

→ Ablation, then fusing

~~Braid~~

Compression causes "Chinese Finger cuff" effect if braid is not held down - may be the reason for using shrink tubing, then grinding. (get no axial compression that way.) → only radial compression

Otherwise EPO TEK 390 does a good job.



Note: Danvers does the overlay successfully - without compression ~~used~~ uses shrink tubing.

Apply adhesive with ~~Bryant~~ inkjet.

6 mm cut tip

Temp : 400°F

TC Insulation : PET Polyester Shrink Tubing - clear.

Advanced Polymers

AVG ID : 14 Mils

Avg wall : .23 Mils.

Item : 014023CST Lot 980227 #1

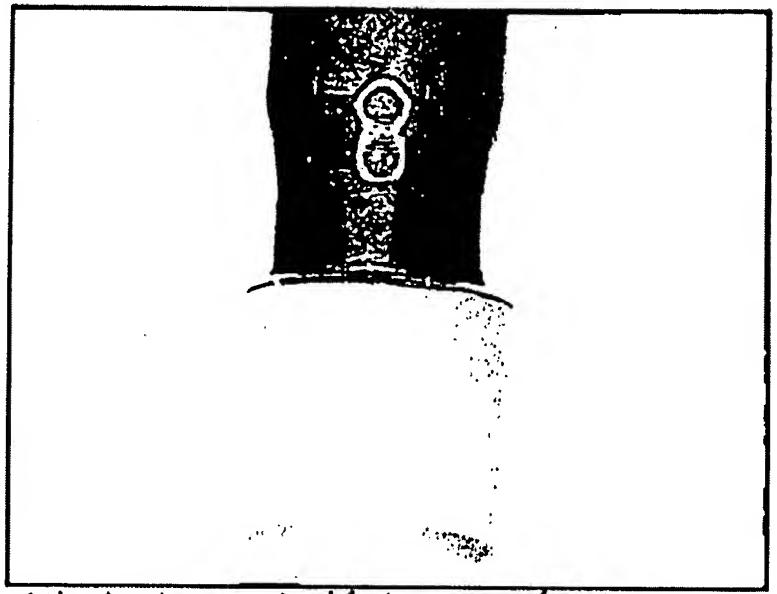
Shrink over bare end of TC at 500°F

---

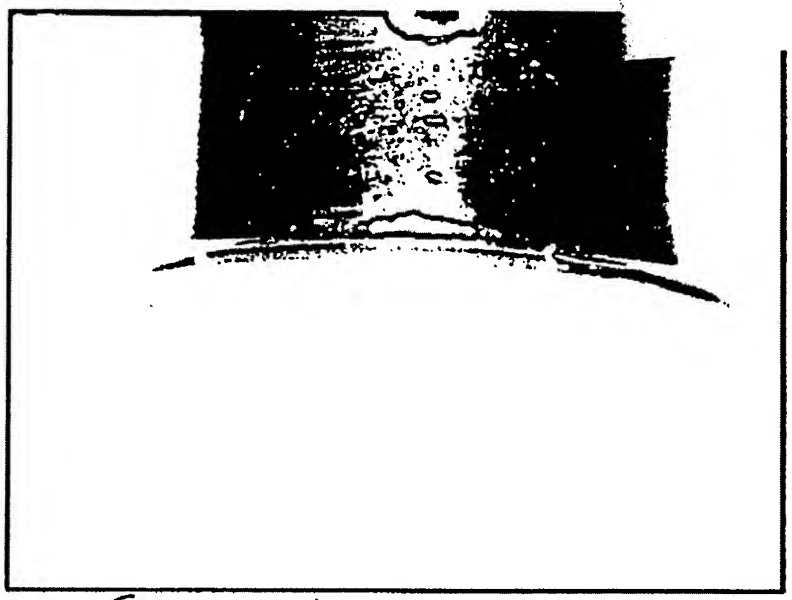
4 mm cut

400°F melt

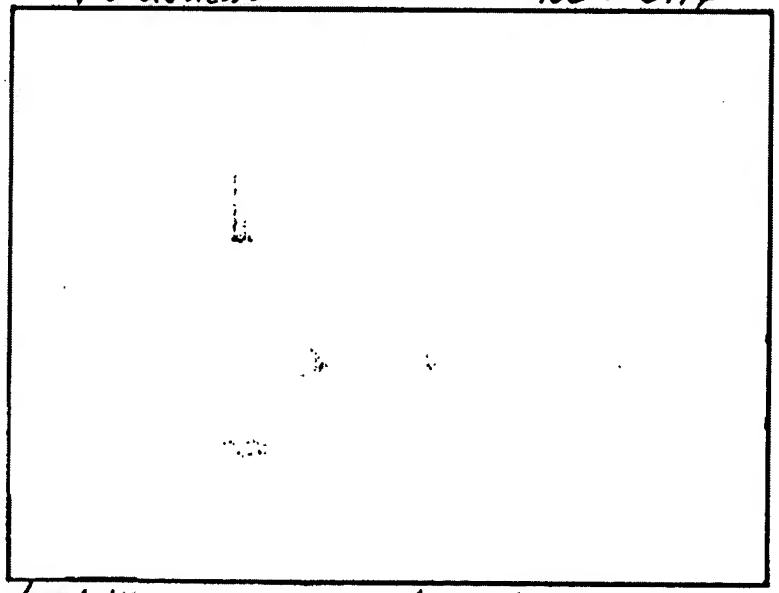
330°F reflow / relax



Tip 120181-004 lot 681238 Insul: 170343-004
No adhesive lot 720144

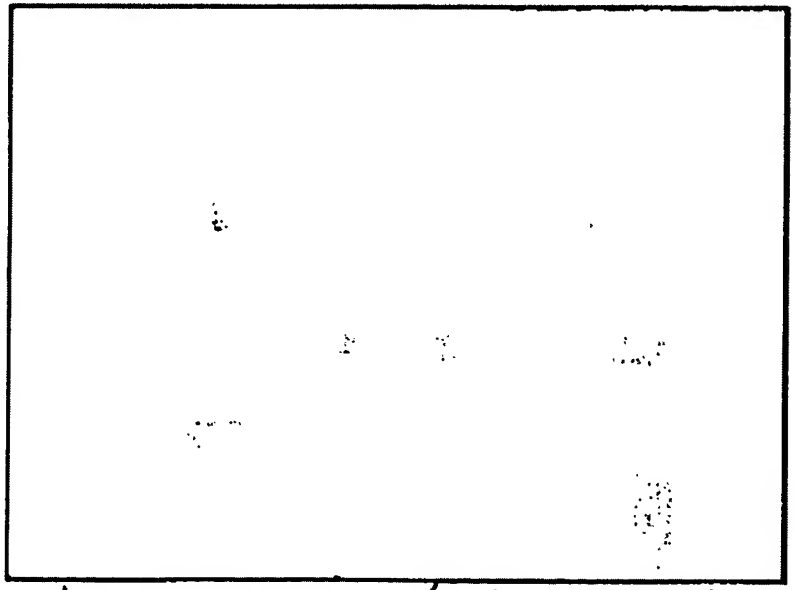


← Same as, closer image



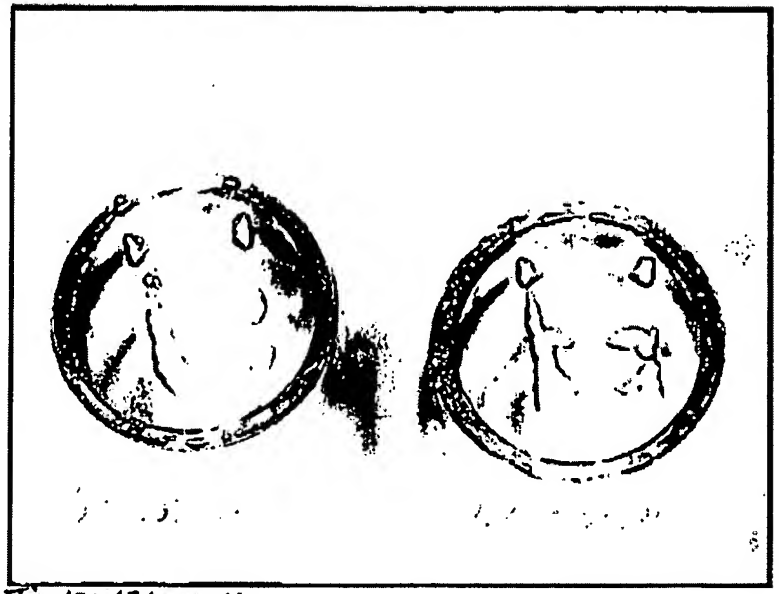
Insul 153159-001
lot: 721608

Insul 170343-004
lot 720144

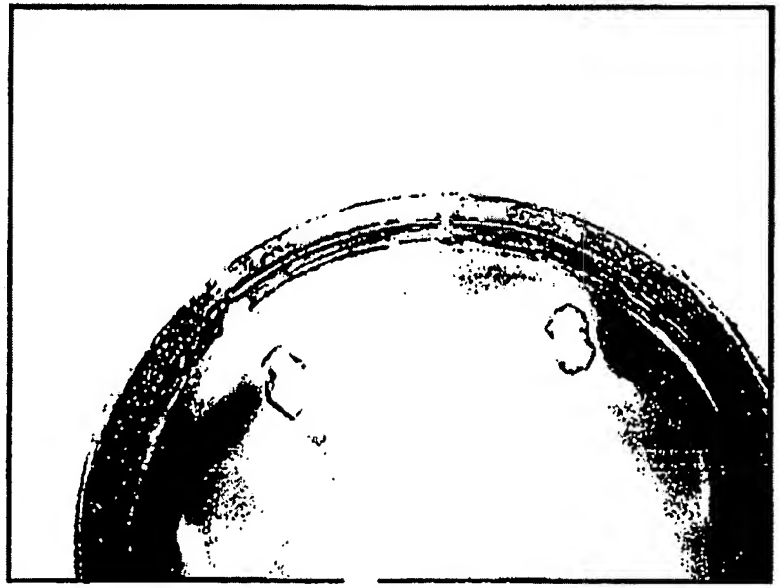


Insul 153159-001
lot: 721608

Insul 170343-004
lot 720144

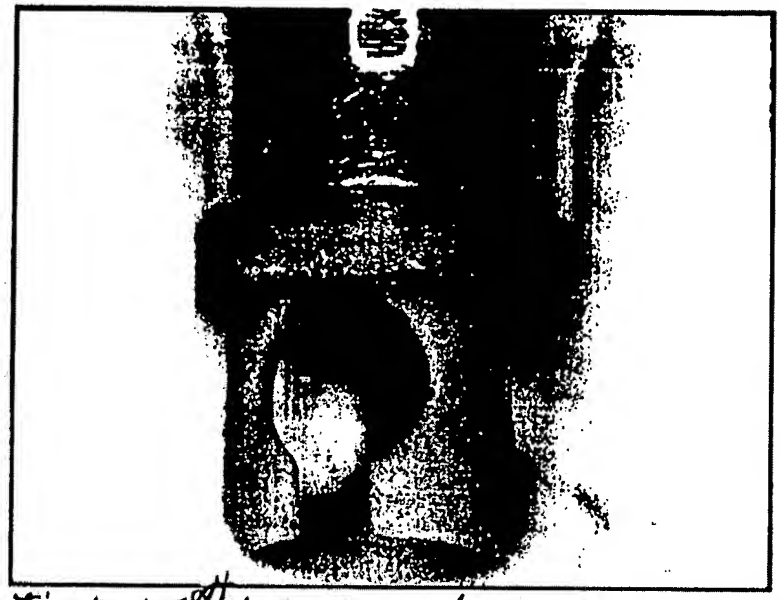


Tip 120181-004

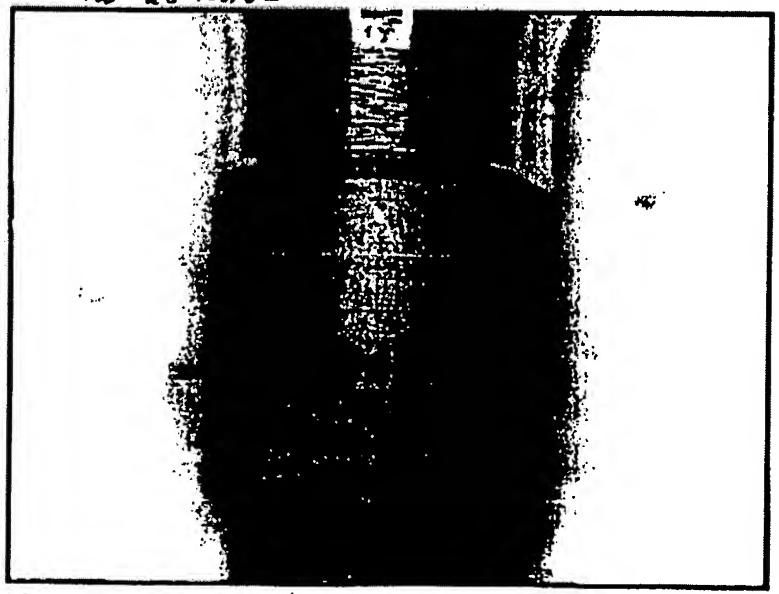


Tip 120181-004 lot 681238

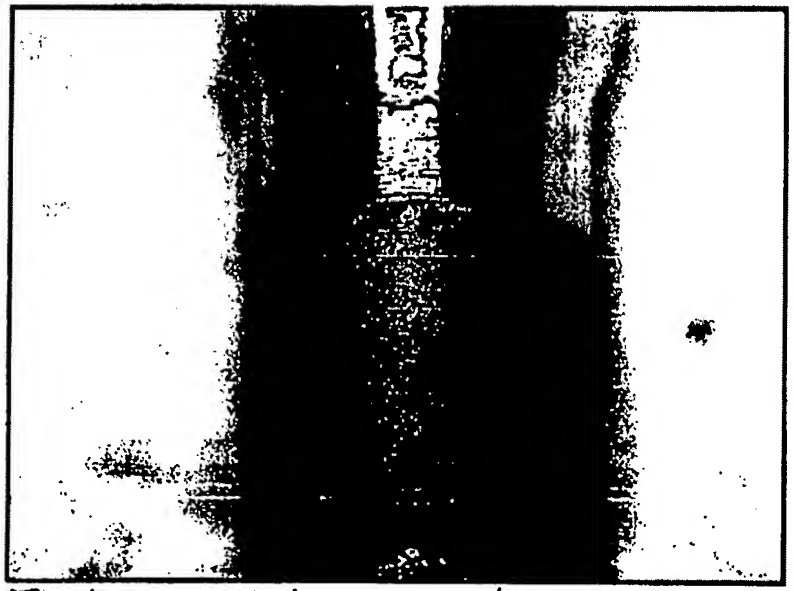
Tip 120181-004 lot 732812



Tip: 120181-004 lot 732812 Insul: 153159-001 lot 721608
No adhesive



Tip: 120181-004 lot 732812 Insul: 170343-004
No adhesive lot 720144



Tip 120181-004 lot 732812 Insul: 170343-004
with Adhesive lot 720144